FOOD AND DIET

IN

HEALTH AND DISEASE

BY

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TO

GEORGE BEN JOHNSTON, M.D., LL.D.

PREFACE.

In the preparation of this book an effort has been made to present concisely the principles, at present known, upon which rests the intelligent use of food in health and in disease. Technicalities have been as far as possible avoided, in order that the subject may be intelligible to persons without technical training.

In the grouping of the individual foods, a departure has been made from the usual custom of dividing them into "animal" and "vegetable." Arrangement according to the predominating alimentary substance will serve better to distinguish foods from the point of view of their practical uses in the body.

Part I. is largely based upon the work of the Experiment Stations of the United States Department of Agriculture, as published in the *Farmers' Bulletin*, from which all the tables used have been taken, unless otherwise specified. Some diseases customarily treated of in books on this subject have been omitted from Part II., since the details of their dietetic management are direct corollaries of oft-repeated principles elsewhere herein set forth, or else their management requires institutional care, which lies beyond the scope of this book.

In preparing the text I have drawn liberally from the standard works on dietetics and have made free use

of monographs and the current literature of the best dieticians of this country and Europe.

Acknowledgment is hereby made of the helpful assistance of Dr. P. St. George Grinnan, in preparing the chapter on Food in Infancy, and of Dr. F. H. Beadles, in writing the chapter on Food in Diseases of the Skin. My thanks are also due to Miss R. Z. Van Vort, Superintendent of the Memorial Hospital, for arranging the diet lists and recipes, and to Dr. W. A. Shepherd for aid in proof-reading and in the preparation of the index.

R. F. W.

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PART I.

FOOD IN HEALTH.

CHAPTER I.

CHEMISTRY. RELATION OF FOODS TO THE BODY. HOW THE BODY REQUIREMENTS ARE SUPPLIED BY FOODS. SOURCE OF FOODS. ESTIMATION OF FOOD VALUES.

From whatever point of view considered, there is no biological study which presents such problems or holds such interest as that very complex structure, the Human Body.

It is a machine which is capable of providing numerous mechanical effects. It is a laboratory wherein force is developed. A living organism, it possesses functions inimitable by the mechanic or the scientist, and in some mysterious way it is the effective agent for the outward manifestation of the activities of that intangible thing which we call Mind.

Chemical action, liberated and made effective by the living organism, produces force which is variously made manifest in the body as heat, muscular contraction, glandular secretion, or mental activity.

These functions—mechanical, chemical, and vital, so different in their nature—are interdependent. In health

the body is a perfect self-regulating and self-supplying machine. But that intricate correlation of its parts, which produces harmony of function, may in disease affect all of them by the derangement of one.

When one considers the variety of organs in the body —muscles, digestive apparatus, lungs, heart, kidneys, brain—which, by their simultaneous activities, are using up force, he may well wonder at the enormous amount of work done in the body, since motion, secretion, respiration, circulation, elimination, thought, and feeling are all work, and simply the different forms in which energy or force is expended. This work of the organs never ceases, for even in sleep their activity continues, though more slowly, and cessation of their function leads to their disintegration and death; Nature does not permit idleness. As with other machines, work causes proportionate wear and tear, so in the human body does the expenditure of force in functional activity use up its structural materials. Waste follows exercise of function, and it is evident that repair in the organs must continually be made and force supplied, if this efficiency is to be preserved. The source of supply of both of these necessities is Food. But just as there is a difference in the steam-producing power of different kinds of fuel and consequent economical advantages in selection, so is there a difference in the value of the various foodstuffs, depending jointly on their chemical composition and physical structure.

Chemical analysis shows the body to contain some fifteen to twenty different elements. Just what part many of them play is not known. The predominating elements are oxygen, hydrogen, carbon, nitrogen, calcium, phosphorus, and sulphur. These exist in various combinations

to form the different substances of which the tissues—muscle, bone, fat, tendons, etc.—are made. The more important of these substances, termed "alimentary substances," are proteid, fats, carbohydrates, salts or mineral matter, and water.

Proteid forms about 18 per cent. of the body weight, furnishes the basis of nearly all of its tissues, and occurs in many of its fluids. It is found in the body in three forms, albuminoids, gelatinoids, and extractives. The albuminoids form a large proportion of lean meat and milk; the gelatinoids occur principally in the bones, tendons, gristle, and skin. These two forms are collectively spoken of as "proteids."

Fats form about 15 per cent. of the body weight and are found scattered throughout the tissues in minute particles and in layers or masses about various organs and under the skin, where they are stored to be drawn upon when needed for supplying force. Thus distributed, fats aid in lubricating, prevent harmful friction on motion, give rotundity to the figure, and serve as protection to the body against cold and injury.

Carbohydrates (starches and sugars) form only about 1 per cent. of the body weight and are found chiefly as glycogen (animal starch) in the liver and as the sugar of milk.

Water forms about 60 per cent. of the body weight. It enters into the structural composition of every tissue of the body and is the basis of all of the fluids.

Salts, or mineral matter, form 5 or 6 per cent. of the body weight and occur most abundantly in the more solid structures of the body, as in the bones and teeth, which are nearly half formed of calcium phosphate, but

they are found in all tissues and fluids of the body in the form of various compounds of calcium, sodium, potassium, magnesium, iron, and other bases.

These last two—water and salts, which occur ready formed in nature—are termed inorganic compounds, in contradistinction to the other three, which are called organic, as the activity of living organs, either animal or vegetable, is necessary for their elaboration.

These, then, are the materials which undergo destruction and must be continually replaced by food. A perfect or complete food is one which supplies all of these necessary substances in proper proportion to repair the tissues and furnish adequate force for the performance of their functions. Could such a single food for man be found, the subject of dietetics would be a simple one; but as such does not exist, man must seek his supply from various materials drawn from the animal and vegetable kingdoms.

These two sources of food supply give a basis for a sufficient classification of foods into animal foods and vegetable foods, a natural division according to the forms in which we supply ourselves in the markets, and in a general way a logical division from the point of view of the composition of the foods. For, though certain ingredients, proteid, for example, are to be found in both animal and vegetable foods, they occur under such variant conditions and in such different amounts, that their utilization by the body is far from equal, and the differences in the two classes are so great, both as to composition and use in the body, that separation is necessary for any classification.

The substances forming the tissues of animal foods are identical in character with those of the human body, and

hence contribute chiefly to its repair; but while life may be supported by these alone, the proper development of energy can better be accomplished by certain products more abundantly supplied by the vegetable foods. This will be easily understood as the uses of the different alimentary substances are studied.

Proteid is composed of carbon, hydrogen, oxygen, and nitrogen with sulphur or phosphorus. It is supplied abundantly in animal foods and occurs in considerable quantities in cereals and largely in peas and beans. Its presence in other vegetable products is inconsiderable.

Albuminoids are familiar in the form of white of egg (albumin), the lean of meat (myosin), milk curd (casein), and the gluten of wheat. Their primary function is building and repairing the nitrogenous tissues and fluids of the body, and for this purpose no other class of food can be satisfactorily substituted. It has further important functions in the body in regulating the absorption of oxygen, thereby stimulating functional activity, and to some extent in furnishing heat and energy. The albumin that is appropriated from the food by the formed tissues is termed "organic albumin" and is quite stable, comparatively little of it undergoing change under normal conditions. That which exists in the fluids, called "circulating albumin," is more easily broken up into nitrogenous waste material, such as urea, and into a non-nitrogenous substance, part of which is oxidized, producing heat and energy, part being converted into fat and as such stored in the body. When the supply of force-producing food is inadequate and in certain morbid conditions, the albuminoids may be extensively used to produce heat and energy, and this causes emaciation by diverting this sub-

stance from its usual function of forming and repairing tissue. Albuminoids may thus, with water and salts, support life alone, but to supply the necessary carbon such enormous quantities would be required as would greatly tax the digestive and eliminative organs.

Gelatinoids are richer in nitrogen than the albuminoids, but they are so promptly decomposed in the body that they are useless for repairing the tissues. This decomposition, however, is a source of force and their presence in food lessens the draft upon the albuminoids. They are useful, therefore, as "albumin sparers," thus permitting the albuminoids to be more used for tissue building or enabling the repair processes to be maintained by a smaller amount of albumin. This is of practical importance in those pathological conditions which make a drain on the organic albumin.

Extractives are also nitrogenous compounds, but they are lacking both in tissue-building and force-producing power. Their chief function appears to be stimulation of the upper digestive tract, thus increasing appetite. They form the principle ingredient of beef tea, meat extracts, etc.

Fats are composed of carbon, hydrogen, and oxygen. They occur abundantly in animal foods as the fat of meat and fish and as butter. They are also present in many vegetable foods, as corn, nuts, and olives. They are rich in carbon and vary greatly in their physical condition, some being firm and hard, others soft and even liquid. Fat subserves two purposes in the body. It is with the carbohydrates, the chief source of heat and force, which are produced by its oxidation. What is not so used is stored in the body for call when needed. Another purpose, and

an important one, is to spare the waste of the albuminoids. The albuminoids increase tissue waste through combustion, but the fats retard it, and by their own combustion spare the albumins. By the proper use of fats, therefore, less albuminoid food will be needed to maintain the tissues in a state of proper repair.

Carbohydrates are compounds of carbon, oxygen, and hydrogen. They differ chemically from the fats in containing oxygen and hydrogen in such proportions as to form water after combustion. They occur in foods as the starches, sugars, and plant fibre or cellulose, and are familiarly recognized in many cereals and vegetables. Their use in the body is the production of heat and energy. They are readily oxidized, more readily than the fats, and so form a powerful source of heat production. The small amount stored in the body, as compared with the other alimentary substances, indicates how thoroughly they are destroyed in the body in the production of force. A small amount is stored in the liver as glycogen, or "animal starch." The body has the power of converting carbohydrates into fat, and under certain circumstances they undergo this change and serve in this way to add to the supply of stored force-producing material.

It is evident, then, that the different organic alimentary substances can do each other's work when necessary, except the repair of tissue, for which the albuminoids alone suffice.

Salts occur in varying quantity in all foods, the cereals containing most, vegetables next, then meats, and lastly fruits and nuts. Like the albuminoids, the salts perform functions that cannot be substituted by other alimentary substances. They enter into the structural composition

of all the tissues and fluids and control many functions necessary to life. The specific gravity of the body fluids is regulated by them, and they control the rate of osmosis or absorption, and maintain the chemical reaction of the fluids. Thus the blood is kept alkaline by the phosphates of sodium and potassium and by the carbonate and bicarbonate of sodium, while the acid phosphate of sodium is the chief agent in keeping the urine acid. Calcium is the mineral most abundantly found in the body. It occurs in some form in every tissue of the body, and its presence appears to be essential for cell growth. Its phosphate composes about half of the substances of bone. In less quantity, but of equal importance, is sodium chloride, which enters into the composition of all the fluids and tissues of the body, except the enamel of the teeth. It furnishes chlorine for the elaboration of hydrochloric acid in the gastric juice, thus stimulating the appetite. It acts as a preservative, preventing decomposition and putrefaction of the tissues, and it keeps the albuminous substances of the blood in a state of solution. Its presence is essential to life. Potassium salts predominate in muscular tissue and occur in less amount widely distributed in the other tissues and fluids of the body. Many other salts occur in the body which promote metabolism and aid in keeping alkaline the interstitial fluids.

Sufficient salts for health are provided in the food of a properly balanced diet, but it is customary to add sodium chloride (common table salt) to certain foods to improve the taste and increase the appetite. This excess is entirely eliminated by the urine.

Water occurs in varying amount in all foods and is further introduced into the body in the form of various

beverages. It is essential for life, not only because it is a component of all tissues and fluids of the body, but on account of certain functions that it performs. It is the great solvent of all foods and thus distributes nutriment to the tissues, and in like manner removes the waste products of combustion and carries them to the organs of elimination. It distributes body heat, being a good conductor, and aids in keeping the equilibrium of normal temperature by its absorption and elimination. It maintains the proper dilution of the blood and promotes free circulation. The amount necessary varies under different circumstances, such as humidity, temperature, and exercise, but the average amount needed for a healthy man under ordinary conditions is about five pints daily in some form. Need for water is usually manifested by thirst, a sensation referred to the mouth on account of the dryness of the mucous membranes which usually accompanies the condition, but it is, in fact, a call through the nervous system for a greater supply to the tissues throughout the body. Deficiency of water is one of the commonest dietetic errors.

Though, as has been stated, the proteids may be called upon under certain conditions to furnish energy, their peculiar use is to replace tissue waste and to build new tissue, while the fats and carbohydrates must be depended upon as sources of heat and energy. Muscular activity does not increase the metabolism of proteids in the body, but does use up the non-nitrogenous substances. The need for more albuminous food under great muscular exertion is due to the fact that strong, large muscles are necessary to meet the excessive requirement put upon them, and the use of proteid food in quantity for special

training, as in athletic contests, is for the purpose of increasing the muscular tissues and improving the condition of the nerve centres, so that the energy required may be quickly released. In other words, under normal conditions increased activity will demand proportionately greater increase of fats and carbohydrates than of proteids.

Modern science has developed means for estimating the nutritive value of the various foodstuffs. By burning the food in oxygen the amount of heat which can thereby be developed is measured, and this heat, called "the heat of combustion," is taken as the gauge of the potential energy of the food, as the different forms of energy are mutually convertible. The unit of measurement is the calorie, which represents the amount of heat necessary to raise the temperature of one kilogram of water one degree Centigrade, or one pound of water four degrees Fahrenheit. This is equivalent to the mechanical force required to lift one ton about one and a half feet. In this way it has been determined that proteid has fuel value of four calories per gram, or 1820 calories per pound, and carbohydrates the same, while fats produce 8.9 calories per gram, or 4040 calories per pound. If, therefore, by chemical analysis, the relative proportions of alimentary substances of any given food be determined, the fuel value of the food can readily be calculated from the figures above. The actual nutritive value of a food will never be equal to the estimated fuel value, as variation in digestion will affect the amount absorbed, and oxidation in the body is never as complete as in the experiments outside of the body.

Furthermore, the digestibility of foods of the same class

will vary according to their source. Persons pursuing various occupations have been fed on different foods, the amount ingested and the excreta being carefully weighed. The difference between these weights gave the amount absorbed which was utilized by the body. While it was found that in ordinary mixed diet about 92 per cent. of the proteid, 95 per cent. of the fats, and 97 per cent. of the carbohydrates are retained in the body, experiments with single foods showed as an average that about 97 per cent. of the proteids, 95 per cent. of the fats, and 98 per cent. of the carbohydrates of animal foods are absorbed, but only 84 per cent. of the proteid and 90 per cent. of the fat of the vegetable foods, though 97 per cent. of the carbohydrates from the latter are retained. From this it is evident that proteid and fat of animal origin are more readily digested than similar substances of vegetable origin. The digestibility of a given article of food will depend upon the proportions of these various ingredients.

Thus of two cereals, the one which contains proportionately less of the less easily digestible proteid, and more of the more digestible carbohydrates, will be more easily digestible than the other. Knowing, then, the proportions of alimentary substances in a given food and the percentage digestibility of each, the nutritive value in calories can be readily estimated.

The average composition of common American food products is as follows:

TABLE I.

Food materials (as purchased).	Refuse.	Water.	Proteid.	Fats.	Carbohydrates.	Ash.	Fuel value per pound.
ANIMAL FOOD.	%	%	%	%	%	%	Calories.
Beef, fresh:							
Chuck ribs	16.3	52.6	15.5	15.0	......	0.8	910
Flank	10.2	54.0	17.0	19.0	......	0.7	1105
Loin	13.3	52.5	16.1	17.5	......	0.9	1025
Porterhouse steak	12.7	52.4	19.1	17.9	......	0.8	1100
Sirloin steak	12.8	54.0	16.5	16.1	......	0.9	975
Neck	27.6	45.9	14.5	11.9	......	0.7	1165
Ribs	20.8	43.8	13.9	21.2	......	0.7	1135
Rib rolls	......	63.9	19.3	16.7	......	0.9	1055
Round	7.2	60.7	19.0	12.8	......	1.0	890
Rump	20.7	45.0	13.8	20.2	......	0.7	1090
Shank, fore	36.9	42.9	12.8	7.3	......	0.6	545
Shoulder and clod	16.4	56.8	16.4	9.8	......	0.9	715
Fore quarter	18.7	49.1	14.5	17.5	......	0.7	995
Hind quarter	15.7	50.4	15.4	18.3	......	0.7	1045
Beef, corned, canned, pickled, dried:							
Corned beef	8.4	49.2	14.3	23.8	......	4.6	1245
Tongue, pickled	6.0	58.9	11.9	19.2	......	4.3	1010
Dried, salted, and smoked	4.7	53.7	26.4	6.9	......	8.9	790
Canned boiled beef	......	51.8	25.5	22.5	......	1.3	1410
Canned corned beef	......	51.8	26.3	18.7	......	4.0	1270
Veal:							
Breast	21.3	52.0	15.4	11.0	......	0.8	745
Leg	14.2	60.1	15.5	7.9	......	0.9	625
Leg cutlets	3.4	68.3	20.1	7.5	......	1.0	695
Fore quarter	24.5	54.2	15.1	6.0	......	0.7	535
Hind quarter	20.7	56.2	16.2	6.6	......	0.8	580
Mutton:							
Flank	9.9	39.0	13.8	36.9	......	0.6	1770
Leg, hind	18.4	51.2	15.1	14.7	......	0.8	890
Loin chops	16.0	42.0	13.5	28.3	......	0.7	1415
Fore quarter	21.2	41.6	12.3	24.5	......	0.7	1235
Hind quarter, without tallow	17.2	45.4	13.8	23.2	......	0.7	1210
Lamb:							
Breast	19.1	45.5	15.4	19.1	......	0.8	1075
Leg, hind	17.4	52.9	15.9	13.6	......	0.9	860
Pork, fresh:							
Ham	10.7	48.0	13.5	25.9	......	0.8	1320
Loin chops	19.7	41.8	13.4	24.2	......	0.8	1245
Shoulder	12.4	44.9	12.0	29.8	......	0.7	1450
Tenderloin	......	66.5	18.9	13.0	......	1.0	895
Pork, salted, cured, and pickled:							
Ham, smoked	13.6	34.8	14.2	33.4	......	4.2	1635
Shoulder, smoked	18.2	36.8	13.0	26.6	......	5.5	1335
Salt pork	......	7.9	1.9	86.2	......	3.9	3555
Bacon, smoked	7.7	17.4	9.1	62.2	......	4.1	2715
Sausage:							
Bologna	3.3	55.2	18.2	19.7	......	3.8	1155
Pork	......	39.8	13.0	44.2	1.1	2.2	2075
Frankfort	......	57.2	19.6	18.6	1.1	3.4	1155
Soups:							
Celery, cream of	......	88.6	2.1	2.8	5.0	1.5	235
Beef	......	92.9	4.4	0.4	1.1	1.2	120
Meat stew	......	84.5	4.6	4.3	5.5	1.1	365
Tomato	......	90.0	1.8	1.1	5.6	1.5	185

TABLE I. (Continued).

Food materials (as purchased).	Refuse.	Water.	Proteid.	Fats.	Carbohydrates.	Ash.	Fuel value per pound.
ANIMAL FOOD (continued).	%	%	%	%	%	%	Calories.
Poultry:							
Chicken, broilers	41.6	43.7	12.8	1.4	......	0.7	305
Fowl	25.9	47.1	13.7	12.3	......	0.7	765
Goose	17.6	38.5	13.4	29.8	......	0.7	1475
Turkey	22.7	42.4	16.1	18.4	......	0.8	1060
Fish:							
Cod, dressed	29.9	58.5	11.1	0.2	......	0.8	220
Halibut, steaks or sections	17.7	61.9	15.3	4.4	......	0.9	475
Mackerel, whole	44.7	40.4	10.2	4.2	......	0.7	370
Perch, yellow, dressed	35.1	50.7	12.8	0.7	......	0.9	275
Shad, whole	50.1	35.2	9.4	4.8	......	0.7	380
Shad, roe	......	71.2	20.9	3.8	2.6	1.5	600
Fish, preserved							
Cod, salt	24.9	40.2	16.0	0.4	......	18.5	325
Herring, smoked	44.4	19.2	20.5	8.8	......	7.4	755
Fish, canned:							
Salmon	......	63.5	21.8	12.1	......	2.6	915
Sardines	5.0[1]	53.6	23.7	12.1	......	5.3	950
Shellfish:							
Oyster "solids"	......	88.3	6.0	1.3	3.3	1.1	225
Clams	......	80.8	10.6	1.1	5.2	2.3	340
Crabs	52.4	36.7	7.9	0.9	0.6	1.5	200
Lobsters	61.7	30.7	5.9	0.7	0.2	0.8	145
Eggs: Hens' eggs	11.2[2]	65.5	13.1	9.3	......	0.9	635
Dairy products, etc.:							
Butter	......	11.0	1.0	85.0	......	3.0	3410
Whole milk	......	87.0	3.3	4.0	5.0	0.7	310
Skim milk	......	90.5	3.4	0.3	5.1	0.7	165
Buttermilk	......	91.0	3.0	0.5	4.8	0.7	160
Condensed milk	......	26.9	8.8	8.3	54.1	1.9	1430
Cream	......	74.0	2.5	18.5	4.5	0.5	865
Cheese, Cheddar	......	27.4	27.7	36.8	4.1	4.0	2075
Cheese, full cream	......	34.2	25.9	33.7	2.4	3.8	1885
VEGETABLE FOOD.							
Flour, meal, etc.:							
Entire-wheat flour	......	11.4	13.8	1.9	71.9	1.0	1650
Graham flour	......	11.3	13.3	2.2	71.4	1.8	1645
Wheat flour, patent roller process—							
High grade and medium	......	12.0	11.4	1.0	75.1	0.5	1635
Low grade	......	12.0	14.0	1.9	71.2	0.9	1640
Macaroni, vermicelli, etc.	......	10.3	13.4	0.9	74.1	1.3	1645
Wheat breakfast food	......	9.6	12.1	1.8	75.2	1.3	1680
Buckwheat flour	......	13.6	6.4	1.2	77.9	0.9	1605
Rye flour	......	12.9	6.8	0.9	78.7	0.7	1620
Cornmeal	......	12.5	9.2	1.9	75.4	1.0	1635
Oat breakfast food	......	7.7	16.7	7.3	66.2	2.1	1800
Rice	......	12.3	8.0	0.3	79.0	0.4	1620
Tapioca	......	11.4	0.4	0.1	88.0	0.1	1650
Starch	......	......	......	......	90.0	......	1675
Bread, pastry, etc.:							
White bread	......	35.3	9.2	1.3	53.1	1.1	1200
Brown bread	......	43.6	5.4	1.8	47.1	2.1	1040

[1] Refuse, oil. [2] Refuse, shell.

TABLE I. (Continued).

Food materials (as purchased).	Refuse.	Water.	Proteid.	Fats.	Carbohydrates.	Ash.	Fuel value per pound.
VEGETABLE FOOD (continued).	%	%	%	%	%	%	Calories.
Bread, pastry, etc.							
Graham bread	......	35.7	8.9	1.8	52.1	1.5	1195
Whole-wheat bread	......	38.4	9.7	0.9	49.7	1.3	1130
Rye bread	......	35.7	9.0	0.6	53.2	1.5	1170
Cake	......	19.9	6.3	9.0	63.3	1.5	1630
Cream crackers	......	6.8	9.7	12.1	69.7	1.7	1925
Oyster crackers	......	4.8	11.3	10.5	70.5	2.9	1910
Soda crackers	......	5.9	9.8	9.1	73.1	2.1	1875
Sugars, etc:							
Molasses	......	......	......	......	70.0	......	1225
Candy[1]	......	......	......	......	96.0	......	1680
Honey	......	......	......	......	81.0	......	1420
Sugar, granulated	......	......	......	......	100.0	......	1750
Maple syrup	......	......	......	......	71.4	......	1250
Vegetables:[2]							
Beans, dried	......	12.6	22.5	1.8	59.6	3.5	1520
Beans, Lima, shelled	......	68.5	7.1	0.7	22.0	1.7	540
Beans, string	7.0	83.0	2.1	0.3	6.9	0.7	170
Beets	20.0	70.0	1.3	0.1	7.7	0.9	160
Cabbage	15.0	77.7	1.4	0.2	4.8	0.9	115
Celery	20.0	75.6	0.9	0.1	2.6	0.8	65
Corn, green (sweet), edible portion	......	75.4	3.1	1.1	19.7	0.7	440
Cucumbers	15.0	81.1	0.7	0.2	2.6	0.4	65
Lettuce	15.0	80.6	1.0	0.2	2.5	0.8	65
Mushrooms	......	88.1	3.5	0.4	6.8	1.2	185
Onions	10.0	78.9	1.4	0.3	8.9	0.5	190
Parsnips	20.0	66.4	1.3	0.4	10.8	1.1	230
Peas (*Pisum sativum*), dried	......	9.5	24.6	1.0	62.0	2.9	1565
Peas (*Pisum sativum*), shelled	......	74.6	7.0	0.5	16.9	1.0	440
Cowpeas, dried	......	13.0	21.4	1.4	60.8	3.4	1505
Potatoes	20.0	62.6	1.8	0.1	14.7	0.8	295
Rhubarb	40.0	56.6	0.4	0.4	2.2	0.4	60
Sweet potatoes	20.0	55.2	1.4	0.6	21.9	0.9	440
Spinach	......	92.3	2.1	0.3	3.2	2.1	95
Squash	50.0	44.2	0.7	0.2	4.5	0.4	100
Tomatoes	......	94.3	0.9	0.4	3.9	0.5	100
Turnips	30.0	62.7	0.9	0.1	5.7	0.6	120
Vegetables, canned:							
Baked beans	......	68.9	6.9	2.5	19.6	2.1	555
Peas (*Pisum sativum*), green	......	85.3	3.6	0.2	9.8	1.1	235
Corn, green	......	76.1	2.8	1.2	19.0	0.9	430
Succotash	......	75.9	3.6	1.0	18.6	0.9	425
Tomatoes	......	94.0	1.2	0.2	4.0	0.6	95

[1] Plain confectionery not containing nuts, fruit, or chocolate.

[2] Such vegetables as potatoes, squash, beets, etc., have a certain amount of inedible material, skin, seeds, etc. The amount varies with the method of preparing the vegetables, and cannot be accurately estimated. The figures given for refuse of vegetables, fruits, etc., are assumed to represent approximately the amount of refuse in these foods as ordinarily prepared.

CHAPTER II.

PHYSIOLOGY. DIGESTIVE PROCESSES. AGREEMENT OF FOODS.

It was seen in the preceding chapter how the different substances composing animal and vegetable foods supply the body with its nutriment and energy. Before these substances can be utilized by the body, however, they must be absorbed and distributed by the blood to the various tissues and fluids. Salts and water are absorbed unchanged, but the other alimentary substances, such as proteid and carbohydrates, must first be rendered soluble and diffusible before absorption is possible. The very complex process by which this is attained is termed digestion.

Digestion is accomplished partly by mechanical means through the action of muscles, and partly by chemical action of the digestive fluids. Both methods start in the mouth.

By mastication or chewing the food is broken up and subdivided, thus increasing tremendously the surfaces of contact for the action of the digestive fluids. Thus the food is thoroughly mixed with the saliva, which, besides having chemical action, dissolves some of the constituents and lubricates the bolus, making it easy to swallow. The importance of this is often disregarded, and food is swallowed in large masses, which successfully resist the action of the gastric juice, leading to indigestion and disease.

By the act of swallowing, the bolus is carried back into the pharynx and then passes down the œsophagus into the stomach. This is accomplished by rhythmical and successive action of the muscles of which these parts are formed. In passing over the larynx into the pharynx the entrance of food into the larynx is prevented by the closure of its opening by the epiglottis, over which the food passes into the pharynx. All of this action is comparatively rapid.

The muscular action of the stomach proceeds more slowly. Here the food is further broken up and mixed with the gastric juice by a churning movement. The food remains in the stomach until it is reduced to a semifluid condition, which takes from one and a half to five hours, according to the substances used for food, and is then propelled into the intestine. This entrance of food into the intestine does not occur all at once, but from time to time throughout the period of gastric digestion.

In the intestine the food is further subjected to the action of the pancreatic juice and the secretions of the intestine and liver. The rhythmic, successive contraction of the muscles of the intestine wall, called peristalsis, carries the food slowly along the circuitous course of the intestine, and as it thus advances the nutrients, now rendered fluid, are absorbed, and the undigested and waste materials are carried on for final expulsion as feces. Though simple in the narration, these mechanical effects are produced by intricate and delicate structures, and many of the disorders of indigestion have their origin in some interference with this mechanical action, a fact which is too often overlooked, to the detriment of individuals by the unnecessary administration of chemical digestants.

The chemical action, by which the food is rendered fluid, is chiefly effected by substances termed unorganized ferments, though bacteria play some part in the process. These ferments have the peculiarity of producing their effects without loss of their own power or substance. In their presence the different food substances take or give up a molecule of water and split into simpler forms of matter, which are held in solution in the fluids with which they come in contact. They are thus rendered absorbable.

The first of these ferments, ptyalin, is found in the saliva in the mouth. It is most active in a neutral medium, but is active in an alkaline medium like the saliva. Its action is to convert insoluble starch into soluble sugar. It has no effect on cellulose, however, and uncooked starch will therefore escape this action. This action of ptyalin would be practically of no importance if its effects were limited to the short time that the food remains in the mouth, but its action is continued in the stomach for from fifteen to thirty minutes, until the fluid becomes acid in reaction. The first secretion of acid in the stomach simply neutralizes the alkalinity of the saliva, for a little time is required to render the fluids acid. When this occurs, however, the ptyalin is destroyed, so that it does not again become effective in the alkaline medium of the intestines.

Saliva serves the further purpose of dissolving various substances which give taste to the food. Substances which are not soluble in the saliva have no flavor.

The gastric juice contains the ferment pepsin, and hydrochloric acid, together with a milk-curdling ferment, rennin. Pepsin is active only in an acid medium, and though

it is effective in the presence of other acids, its greatest power develops with hydrochloric acid, and this nature provides in the stomach.

Pepsin changes the insoluble proteids into soluble peptones. This change does not affect all of the proteids in the stomach; the unaffected portion passes into the intestine to be there acted upon. This change is not immediate, but proceeds through several stages before the final production of peptones is accomplished. These intermediate substances are called albuminoses or proteoses.

Hydrochloric acid makes the gastric contents acid in reaction, which is necessary to render the pepsin active. It also aids in increasing the solubility of certain substances and has a further function in its antiseptic properties, destroying bacteria and preventing fermentation and the production of harmful products thereby.

Rennin coagulates the casein of milk, forming curd.

The process of intestinal digestion is more complex and more powerful than either salivary or gastric digestion. The pancreatic juice, the bile, the intestinal secretion, called succus entericus, and bacteria all play a part. While the saliva and gastric juices act respectively only on starches and proteids, these substances are acted upon more powerfully in the intestine. Fats are digested only in the intestine.

Pancreatic juice contains four ferments: trypsin, amylopsin, steapsin, and a milk-curdling ferment.

Trypsin, like pepsin, acts on proteids, converting them finally into soluble peptones after a series of intermediate stages has been completed. It differs from pepsin, in that it acts in an alkaline medium and is more rapid than pepsin, as well as more powerful, affecting some proteids

which escape the action of pepsin in the stomach and carrying the digestive process farther than pepsin does.

Amylopsin is the most rapid of any of the ferments of the pancreatic juice. It converts starch into sugar and will even act on unboiled starch, digesting the cellulose envelope. This ferment does not occur in the pancreatic juice of infants under about four months of age. This indicates the unsuitableness of starch as an infant food.

Steapsin splits the fats into fatty acids and glycerin; these acids unite with the alkaline bases and form soaps. The further action of the pancreatic juice on fats is the formation of an emulsion.

The milk-curdling ferment, while present in the pancreatic juice, will rarely be needed for this function, as the milk has previously been curdled by the rennet of the stomach before reaching the intestine.

Succus entericus has the property of changing the character of the sugars. The saliva splits starch into maltose and dextrin, which is subsequently also converted into maltose. Amylopsin also converts starch into maltose. The action of the succus entericus is to convert these forms of sugar into glucose.

Bacterial action, if within normal limits, is useful in aiding the action of the pancreatic juice and breaking up harmful proteids which will be injurious if absorbed. If this is excessive, however, it may be harmful in its results. Those bacteria which have escaped the antiseptic effects of the gastric juice produce lactic acid fermentation of the carbohydrates, resulting in the formation of irritating gases; cellulose is also broken up, and by their action on fats and proteids various acids or ill-smelling substances are produced.

Bile is secreted by the liver and collected in the gall-bladder, from which it is poured out continuously into the intestine. This discharge of bile is increased immediately on the entrance of food into the intestine and again several hours later. The function of bile is to aid the action of the pancreatic juice, especially in the digestion of fat. It renders the intestinal contents more viscid, which hinders somewhat their progress through the intestine, causing them to cling to the intestinal walls. This allows time for proper absorption. It assists in the absorption of fats by aiding in emulsification and helps to render the intestinal contents alkaline. It also has antiseptic power against certain forms of bacteria. Bile salts are reabsorbed lower down in the intestine and return to the liver. Another action of the liver, which affects nutrition, is its power to convert the sugar glucose into a form of starch called glycogen, which is stored in the liver to be utilized as needed by the body for the production of energy. A further function of the organ is reduction of proteid waste to urea, by which an excess of this kind of food is at once eliminated.

These digestive processes just described are all for the purpose of rendering the foodstuffs diffusible, so that they may be absorbed and carried by the blood to the various tissues for assimilation. Absorption normally is practically limited to the stomach and intestine, the small intestine being the chief area for absorption; but the large intestine has this power, though to a limited extent. There are two channels by which absorption occurs—the bloodvessels and lymphatic vessels. Sugars, after conversion into glucose by the succus entericus, are absorbed by bloodvessels and carried to the liver for conversion

and storage as glycogen. Native proteids are readily absorbable, but, as has been shown, are converted into peptones in order to facilitate their absorption. These peptones, however, are poisonous substances when introduced into the blood, and are not found in the blood under normal circumstances. They are reconverted in course of absorption into native proteids (albumin, etc.) by the lining membrane of the intestine, through which they pass before being taken up by the bloodvessels. While absorption of proteid is chiefly by the bloodvessels, a little of it is absorbed by the lymph vessels.

The lymphatic vessels are the chief channel for the absorption of fats and are called lacteals, because of the milky appearance of their contents produced by the fat after absorption. The emulsification of fats that occurs in the intestine assists the steapsin in breaking up the fats into fatty acids and glycerin. These acids and glycerin are absorbed through the mucous membrane of the intestine and by it reconverted into fat, which is then taken up by the lacteals in the form of minute droplets and carried off to be finally deposited in the tissues as fat or burned in the production of heat.

The Agreement of Food.—Some persons who have the power of digesting given articles of food will invariably be made more or less ill by eating them. We then say the food "disagrees." The food may be entirely digestible and well digested, and yct produce disorder. The explanation of this is that in the digestion of food certain by-products are formed which are poisonous and which are absorbed before the bacteria of the intestine can convert them into their ultimate principles, thereby robbing them of their toxic properties.

Considerable variation is shown by different individuals in their utilization of food. Where the same diet is taken by two persons and is equally well digested, there may be decided difference in the work that can be done and in the flesh formed by each. While the appropriation of digested food is of course the most important consideration, since it is only the food absorbed which makes flesh and energy, it is impossible to calculate the amount that will be so utilized, because of the difference in the personal equation of individuals.

CHAPTER III.

COOKING. CHANGES NECESSARY IN NATURAL FOODS TO RENDER THEM DIGESTIBLE. METHODS USED.

Foodstuffs in the condition in which we procure them in the market are, for the most part, unfit for use, being indigestible, and, in order to render them digestible by the human secretions, it is necessary to produce certain changes in their physical condition by the process which we call cooking. This may be performed in a variety of ways, but in whatever manner it is accomplished it produces the following changes: It destroys bacteria and parasites which might produce disease; it develops pleasant odor and taste, which stimulate the appetite and increase the desire for food; it improves the appearance of many foods; it renders the tough and tenacious foods friable, so that they may be more readily broken up by chewing; it separates and loosens the fibre, so that digestive secretions may become intimately mixed with the food substances; and the heat of food served warm, in some cases, increases the digestibility.

Cooking in whatever form is accomplished by heating the food. Different methods of cooking require different degrees of heat, according to the character and size of the substance to be cooked. These may be brought under the influence of heat in either of two ways—by radiation or convection from the source of the heat. These two

ways of heating are familiar to us in the processes of roasting and boiling. All other methods of cooking are variations or modifications of these two.

Roasting.—This is the simplest form of cooking, as it requires no utensils, the food being simply exposed to the direct heat of the fire. It is the form used by uncivilized people and by hunters and trappers who are out of reach of the conveniences necessary for other methods of cooking. It is chiefly used for cooking meats. Here the heat reaches the meat by radiation from glowing coals, and there is about the meat a free circulation of air. This method of cooking retains the nutritive juices and the extractives, which give flavor to the meat, more thoroughly than any other form. The meat should first be exposed to great heat until the surface layers are coagulated and a crust is formed by the evaporation of water, which prevents the escape of juices from within. After this is accomplished, which occurs in a few minutes, if the heat be sufficiently intense, the further cooking should proceed more slowly, in order that the interior of the roast may be properly done without drying it up. The different kinds of albumin of which meat is composed coagulate at different degrees of temperature. The albumin of the blood coagulates at 158° to 160° F., and this degree of heat must be attained in the interior of the roast, in order that the meat may be done. If the heat is carried much beyond this point the fibre shrivels and hardens, and the roast will be overcooked and unfit for use, while if a less degree of heat is used the meat will be underdone.

While cooking, some of the juice from the meat will escape and the surface fat will be melted. This, with a little gelatin, which will be formed from the fibrous tissue,

if the heat be intense enough, composes the "gravy." In roasting, the meat must be constantly "basted"—*i. e.*, frequently covered with this gravy or some other fat, such as butter. The basting tends to diffuse the heat uniformly over the joint, prevents hardening and scorching of the surface, and retards evaporation of the moisture within the joint.

If too strong heat be continued, the fat will undergo decomposition, producing carbon, which shows as the charred, blackened surface, and fatty acids, which produce a penetrating and disagreeable odor. If the heat is not sufficiently great at the beginning of roasting to form a protective crust on the surface, the water from the interior will continue to pass outward and evaporate and the meat will be leathery and tough. In roasting, the free current of air about the meat carries off the volatile materials which are developed in cooking, and the meat will have a delicate flavor. In cooking meat by this method there is considerable loss of weight, which varies, according to different observers, from 20 to 30 per cent., and is due chiefly to the evaporation of water.

Beef, mutton, and game do not require as thorough cooking as veal and poultry. For the former a temperature of 130° F. is sufficient for cooking "rare," but for the latter a temperature of 158° to 160° F. is required.

True roasting cannot be accomplished in the ordinary modern kitchen. In old times "tin kitchens" were used. This was a hood of tin in which the roast was placed, the side next to the fire being left open. The advantage of this was that the heated tin radiated heat to all portions of the joint, while the opening toward the fire allowed the free current of air. So-called roasting in an oven, as

practised in most private kitchens nowadays, is really baking.

Baking.—This method is used for preparing both breads and meats, and cooking is accomplished by exposing the food to radiant heat in an enclosed space. This condition is present in an ordinary oven, from all sides of which heat is radiated to the meat. Being enclosed, the free circulation of air is prevented and the volatile substances developed by cooking cannot escape, but are, to a large extent, absorbed by the meat, which will then have a much stronger and richer flavor and will be much less delicate than roasted meat. The loss in weight by baking is said to be less than in roasting, as evaporation in a confined space will be less rapid. Baked meats are more apt to disagree with persons of delicate digestion than roast meats.

Broiling or Grilling.—This is essentially the same method as roasting, but is applied to smaller pieces of meat, such as steaks and chops. The object of broiling is to form a protecting crust and quickly cook the interior of the meat. The surface of a small piece of meat is relatively much greater than that of a large joint, hence evaporation will be more rapid and a higher temperature is therefore necessary. In broiling, the meat should be placed as close to the coals as possible. The thinner the piece of meat the greater the evaporation. Steaks should therefore be cut thick if they are to be juicy.

Boiling.—By this method of cooking the heat is brought to the meat by convection through water. Here the temperature is 212° F. It is worth remembering that the temperature of water when boiling is not increased by harder boiling, which will have no greater effect in cooking the

meat as far as the heat is concerned than will slow boiling. The commotion produced by hard boiling may somewhat loosen the fibre of meat by the movement it imparts.

The manner of boiling meat will depend upon whether the meat itself or the broth is intended for use. When a large piece of meat, as a joint, is to be used for food, it is to be plunged whole into water that is already boiling. This will cause coagulation of the albuminous material of the surface, which will largely prevent the escape of the meat juices. After this coagulation has formed the cooking should proceed more slowly at a lower temperature, in order to prevent the fibre from becoming tough and shriveled. In boiling the meat some of the soluble constituents pass into the water, a small portion of the soluble albumin, and some of the extractives and salts. This loss of soluble materials in the water makes the flavor of meats cooked by boiling less pleasant than when cooked by roasting, and the lower temperature of boiling water will not develop certain flavors produced by the higher temperature of roasting. In boiling meat in this manner, the loss in weight may be as great as from 20 to 30 per cent.

When the broth is to be used the meat should be very finely divided in order to increase its surface contact with the water, so that as much of the nutrient material may be extracted from it as possible. In making beef-tea and broths this minced meat should be placed in cold water and allowed to stand for some time, as the soluble albumin is more readily dissolved by cold water than hot. It should then be gradually heated up to 160°. If heated beyond this point the albumin is coagulated and presents a flocculent deposit, which often has an unappetizing appearance. Such preparations should never be boiled.

If a little hydrochloric acid be added to the cold water, say four or five drops to a pint, the solvent power of the water for albumin is increased and the broth will be richer. The albuminous material of the flesh of fowls is more readily soluble than that of mutton or beef, the latter being least soluble. Consequently chicken broth is the most nutritious, while beef broth is least so. In making these preparations most of the salts are dissolved out into the broth, practically all of the chlorides, and nearly all of the phosphates. The meat, of course, is unfit for use after making broth, and should be strained out.

In making soup a further variation in method is necessary. As the soups consist largely of gelatin they must be boiled for a long time in order to convert fibrous materials—gristle, bone, tendon, etc.—into gelatin. The meat should, however, be chopped fine in order that as much as possible of the nutrients may be dissolved into the soup. The high temperature at which soup is made will, of course, coagulate the albumin and melt much of the fat, which will float on the surface. In making clear soups, these are removed by straining, so that their nutrient value is practically *nil*. They will, however, contain the gelatin, salts, and extractives, which stimulate the appetite and the flow of gastric juice; hence the custom of taking a small amount of soup at the beginning of dinner. When vegetables are to be added to soups, they should be previously cooked, as a longer period of cooking is required for them.

Simmering.—This method of cooking practically does not differ from boiling and is really a very slow boiling.

Stewing.—In stewing, the meat should be cut into small pieces, but not minced fine. The temperature should not

exceed 160° F., as this will coagulate the albumin in the broth, and if the food be boiled the meat will be shrivelled and dried and unfit for use. When properly stewed, the fibre of the meat is loosened and softened, so that it is easily broken up. Some of the albumin, salts, and extractives are dissolved into the broth. In making stews, vegetables are added and the broth is thick and rich. They should be cooked slowly. This is an economical method of cooking, as the whole food, both meat and broth, is eaten. The loss in cooking is less than in boiling or roasting, not exceeding 20 per cent., which is chiefly due to the evaporation of water. When made simply with meat and vegetables, stews are wholesome and fairly digestible, but the addition of sauces, while possibly making them more palatable, often interferes materially with their digestibility. "Hash" is simply a stew in which the meat used has been previously cooked, and is, therefore, often dry and tasteless. Such a dish should never be used by persons of feeble digestive power.

Braising.—This is, in effect, a combination of roasting and stewing, and is usually applied to meat which is tough or too young. "Braise" is a solution of vegetable and meat juices—say, soup stock with vegetables added. In this the meat is cooked at a high temperature, but lower than boiling, for a long time. A close-covered vessel should be used to prevent evaporation and just sufficient braise to cover the meat, in order that the broth may be concentrated. By this method of prolonged slow cooking, tough meat may be rendered tender and impregnated with the flavor of the vegetables with which it is cooked. Spices or wine added will further increase the flavor. It is usual to partially roast or broil the meat before putting into

the braise. Braising can be best done, however, in an especially prepared vessel, which is arranged so as to put hot coals into the top, by which the meat protruding from the fluid is roasted after the fluid has cooked down. This is an economical form of cooking, as inferior and cheaper parts of the meat may be rendered digestible and palatable.

Frying.—This is also a method of cooking by the conduction of heat and is therein similar to boiling, the difference being that fat is used instead of water. The popular idea of frying is that only sufficient fat is used to prevent the meat from sticking to the skillet. This is an error, however, for such a method is partially frying and partially roasting. True frying consists in immersing the meat suddenly into hot fat. The fat need not necessarily be boiling, but should be sufficiently hot to coagulate the surface albumin. The method is used for pieces of comparatively small size. The coagulation of the surface, as in boiling, prevents the escape of the nutritive juice and extractives and the meat will be juicy and of good flavor. When the meat is plunged into the hot oil, the water of the meat forms a thin film of vapor about the surface, which prevents the fat from entering the substances of the meat. As this vapor accumulates and escapes through the fat, it makes the familiar spluttering noise. Although the fat does not permeate the substances of the meat, a good deal of it will stick to the surface as the meat is lifted out; hence beef or cut meats will be greasy when fried. Where the skin remains on the meat, as in frying chicken or fish, this can be removed before eating, and the flesh will be well cooked and digestible. In frying in this manner it is best to place the meat in a wire basket, by

which it can be readily plunged into the fat and easily removed. After the meat has been immersed long enough to thoroughly coagulate the surface albumin it is well to reduce the temperature, as in other methods of cooking, to allow the interior of the meat to cook more slowly and to prevent hardening and shrivelling of the fibres, though there is more danger of the meat being permeated by the fat than there will be if the heat be maintained until the cooking is completed. Frying by the common method, in which the under surface of the meat only is in the hot fat, is a notoriously unwholesome method of cooking. The water of the meat, which evaporates, can escape more readily, allowing the hot fat to come in closer contact with the surface and so permeate the meat to an unwholesome extent. The development of fatty acids, which cause an unpleasant odor, will occur if the fat burns. These being partially absorbed by the meat, will render it unwholesome and irritating to the stomach.

Steaming is a process of cooking, sometimes used, in which the heat is carried to the food by convection through the vapor of water. In effect it is something like boiling, in that the food is subjected to moist heat, but, as the steam may be superheated, the temperature to which the food is subjected may be higher than 212° F.

The Cooking of Vegetable Foods may be accomplished by any of the methods described, but the majority of vegetables are cooked by boiling, which must usually be done even before cooking them by other methods. The effect of cooking vegetables is to soften the fibre or cellulose and loosen the substance of the vegetable, so that it can be more easily chewed. The chief food ingredient of most vegetables is starch, and by the action of moist heat

the starch granules swell and their coverings are ruptured, liberating their contents, so that they may be acted upon by the saliva and the pancreatic juice. Unless this is accomplished the coverings of the starch granules will effectually combat the action of the saliva and retard the action of the pancreatic juice. Other constituents of vegetable food will be affected, albuminous material and other juices being coagulated, and sugars, gums, and salts dissolved by the water in which they are boiled.

CHAPTER IV.

PROTEID FOODS. MILK. EGGS.

PROTEID is essential to life, and as its function of repairing tissue cannot be performed by any other alimentary substance, it is the most important of the organic foods. It is abundantly supplied in all animal foods and considerably by the cereals and by dried peas and beans of various kinds.

The value of proteids derived from animal and vegetable sources is not equal, however, as vegetable proteid is more difficult of digestion, only 84 per cent. of it being absorbed. On the other hand, 97 per cent. of the animal proteid ingested is absorbed, and its digestion is more rapid. This is probably due to the fact that in all animal foods the proteid is associated with larger or smaller amounts of extractives which stimulate the digestive functions. On account of the greater speed of absorption animal proteid is more promptly utilized for the repair of tissue and will liberate energy more rapidly when the body is called on for sudden or unusual activity, as in athletic contests. This prompter utilization of animal proteid necessitates its more frequent supply.

ANIMAL PROTEIDS. MILK.

Though in the minds of many people milk is considered to be simply a beverage, at least for adults, it is, in fact, food; and as it contains all of the various ali-

mentary substances, it is called a "perfect food" or "complete food." While it is a perfect food for infants, the proportion of its constituents is unsuited for use by adults as a single food.

Milk appears as a uniform, homogeneous, yellowish or bluish-white, opaque liquid. It is, however, an emulsion which gives it its opaque appearance. The foundation of milk is water, in which the nutrient materials are dissolved or held in suspension.

Besides water, milk contains proteid in two forms: casein, which differs from other proteid compounds in that it contains both phosphorus and sulphur, and lactalbumin, which is more or less like the albumin of the blood or white of egg. In addition, it contains lactose, or milk sugar; fat, which is composed of several different kinds, chiefly stearin, palmitin, and olein, and certain others in small amounts which give flavor; and various salts. The water of milk forms from 84 to 90 per cent. of its weight. The solid materials, spoken of collectively as the "total solids," form from 10 to 16 per cent., good average milk having from 12 to 13 per cent. of solids. The proteid, casein and albumin, forms about 3.3 per cent. of the whole milk, or 25 per cent. of the total solids. Milk sugar ranges from 4 to 6 per cent., averaging 5 per cent. of the milk, or about 38 per cent. of the total solids. This sugar is similar chemically to cane sugar, but is not nearly so sweet. The salts form 0.7 per cent. of the whole milk. These ingredients are fairly constant in their percentage; the most variable component of milk is the fat, which may vary from 2 to above 5 per cent. Good unadulterated milk should not fall below 3 per cent. of fat nor will it exceed 5 per cent. A good average milk from a herd

should give about 4 per cent., which would then form about 31 per cent. of the total solids.

Many communities have laws for the prevention of milk adulteration, which require a certain standard. According to this standard the total solids vary from 12 to 13 per cent.; the fat varies from 3 to 3.5 per cent. Accurate estimate of the percentage of solids in milk requires an expensive chemical analysis, so that for ordinary purposes simple means of estimating the fat are adopted as the gauge for the total solids. This is a fair approximation to accuracy, as the other solids vary but little, and such variation as they present will be proportionate to the variation of the fat.

The custom of estimating the quality of milk by means of the fat it contains has often misled persons into the belief that this fat is the sole valuable ingredient of milk. This is, however, a great error, for, while the chief commercial value of the milk is due to the fat, which forms the cream from which butter and the rich cheeses are made, the other ingredients of milk have great value as nutrients, especially the proteid, which is in an easily digestible form.

Variations in milk are due to various causes, and may be so great that it is possible for one man to pay double what another pays for the same value. One of the chief causes of variation is in the breed of the cows. Another important one is in the difference between individual cows of the same breed, although certain general characteristics are present in the milk of all cows of the same breed.

The quality of the milk will vary according to the breed, partly because of the quantity of milk which the given breed produces, but largely because of the manner

in which the fat of the milk occurs. As has been stated, this fat is held in suspension as a fine emulsion, tiny particles of fat being distributed throughout the substance of the milk. These particles of fat can only be seen by a good microscope. Some idea of their minute size may be had when one considers that in good average milk twenty-five of these fat globules placed side by side would represent the thickness of an ordinary sheet of letter paper.

These fat globules are uniformly distributed throughout the milk and held in suspension by the stickiness or viscosity of the fluid, which is due to the albumin and sugar in solution in the water. The fat, being lighter than the water, will rise to the surface on standing and appear as a yellow layer on top, familiar to us as the cream. The more minute these globules, the more slowly will they rise to the surface. In the milk of different breeds there is a great variation in the size of the fat globules, hence in the rate of separation of the cream from the milk. Jersey and Guernsey, sometimes called Alderney, produce a rich milk on which the cream rises rapidly and completely. These are good butter cows, but if the whole milk is to be used, this ready separation of the cream is a positive disadvantage, as it leaves the milk poorer. Durham and Ayrshire cows give a good average milk in which the cream rises slowly, and are, therefore, useful in supplying milk which is to be used whole. Holstein cows give a milk of small fat percentage, but usually in very large quantities.

Variation in the milk of a single cow is greater than that of the mixed milk of a herd. Young cows, as a rule, produce richer milk than old ones. The animal's health, temper, and treatment will all affect the quality of the milk. Where the cow is well cared for and kindly treated

the milk will usually be fairly uniform after lactation is well established. The character of a cow's food does not affect the quality of the milk as much as it does the quantity. The flow is greatest soon after calving and gradually decreases in quantity throughout the period of lactation. As it decreases the richness of the milk in solids slightly increases, though the proportion of fat to other solids may vary from day to day. The first milk given after calving is called colostrum. It contains a large proportion of albumin, which often exceeds the amount of casein, while the sugar percentage is usually low. It is somewhat laxative in effect and is unfit for use for food except for the newborn. This rapidly changes, however, and in a few days after the birth normal milk is usually produced.

The milk of different kinds of animals varies considerably in the proportion of its constituents, though all milk contains water, proteid, fat, carbohydrates, and salts. Besides human milk, that most commonly used is from the cow, the goat, and the ass. Human milk contains more sugar and less proteid than cows' milk, but the fuel value is about the same.

The following is the average composition of these kinds of milk:

Ingredients.	Women.	Cows.	Goats.	Asses.
Water	87.4	87.2	85.7	89.6
Total solids	12.6	12.8	14.3	10.4
Casein	1.0	3.0	3.2	0.7
Albumin	1.3	0.5	1.1	1.6
Total proteid	2.3	3.5	4.3	2.3
Fat	3.8	3.7	4.8	1.6
Sugar	6.2	4.9	4.4	6.0
Salts	0.3	0.7	0.8	0.5
Fuel, value per lb.	319 calories.	313 calories.	365 calories.	222 calories.

In buying milk for food, care should be exercised to see that it is obtained pure. Milk is naturally a pure product,

but is easily rendered unwholesome and may often be adulterated, so that its food value is greatly reduced. It is essential, in order to obtain pure milk, that it be purchased from a dairy known to handle the milk with proper care. The manner of delivery is important, as milk may become contaminated or unclean after leaving the farm during its distribution in the city. The custom of delivering in large cans in which the milk is drawn into measures which have been exposed to the dust of the street is an undesirable method, and it is not uncommon to find dregs of dirt in the bottom of the milk receptacle. When thus delivered, such milk, after it has stood for a little while, is not only repulsive, but may be positively dangerous for use. The safest method of delivery is in bottles filled at the dairy and sealed, if proper care be taken with the cleansing of the bottles. This could greatly be facilitated if the patrons would see to the cleansing of the bottles as soon as emptied, thus preventing the milk remains from decomposing in the bottles before they are returned to the dairy.

Milk may be received pure from the dairy and become contaminated in the house after delivery. If left exposed to dust or flies or placed in ill-ventilated closets, it will become impure in a few hours; or if kept in a refrigerator in the same compartment with meats, vegetables, or fruits, as it quickly absorbs the odorous materials given up by these other foods. All milk contains certain bacteria, even pure milk. Many of these gain access from the air at the time of milking and in handling the milk, and some from the cow itself. These bacteria, constantly present, are not disease germs, but it is due to their action that certain changes occur in the milk, such as souring. To

prevent this, milk should be promptly cooled after milking and kept at a temperature below 50° F.; under such circumstances it may be kept sweet for several days. When milk has been allowed to stand a few hours at a temperature above 50° F. these bacteria proliferate and cause fermentation of the milk sugar, with the production of lactic acid. This acid produces a sour taste and causes the coagulation of the casein, forming clabber. This coagulated casein may be separated by pressure, leaving the fluid, called whey, which contains the lactalbumin and salts.

Casein is coagulated lightly by lactic acid, but is coagulated into a firm clot by stronger acids, such as the hydrochloric acid of the gastric juice. Rennet also coagulates the casein, but heat does not. The lactalbumin is not coagulated by rennet or lactic acid, but is coagulated by heat, and it is this albumin which forms the skin on boiled milk.

The popular notion that an approaching thunder storm causes milk to sour by the effect of electricity and ozone in the atmosphere is a fallacy. That milk does sour suddenly during thunder storms is a fact, but it is due to the bacteria which propagate rapidly in the humid, sultry atmosphere which usually precedes a storm.

Certain forms of fermentation of milk other than souring occur more rarely and are due to the action of different kinds of bacteria. Butyric acid fermentation does not affect the milk, but it does affect the keeping properties of butter. Rancid butter contains a considerable amount of this acid. Alkaline fermentation of milk is occasionally met with, in which the milk is coagulated into a soft, slimy mass, usually with a bitter taste, but not sour, giving an

alkaline or neutral reaction. Slimy fermentation sometimes occurs and prevents the formation of cream and renders the milk unfit for drink. Soapy milk and bitter milk are other types of fermentation sometimes met with.

Alterations in the taste of milk due to bacterial action must be distinguished from the flavors produced by the cow's food. Ragweed, for instance, will cause bitter milk, but the difference in cause is easily recognized, as changes due to the food will be present immediately on milking, while those due to bacterial action develop only after a lapse of several hours.

Many diseases may be transmitted by milk from diseased animals or diseased dairy workmen, such as tuberculosis, typhoid fever, scarlet fever, and diphtheria. Milk which is unclean through careless handling, where particles of manure and other dirt have been allowed to fall into it, may produce serious disease of the alimentary tract.

Milk adulteration is reprehensible, not so much on account of danger to health as on account of dishonesty. The usual methods of adulteration are the removal of cream and the addition of water, and the use of coloring matter or preservatives. If the cream is removed and water added the food value of the milk is reduced, but if the water be pure there is no danger of illness being caused. While the preservatives that are usually added are not harmful in the amounts ordinarily used, the continued ingestion of them may produce harmful results.

Digestibility and Utilization of Milk.—The nutrition derived from any food depends not only on its digestibility, but also on how much of it undergoes digestion, and farther on the amount of digested material which is utilized

by the body. There is great variation in the utilization of any food, as also in the amount which is digested by different individuals, and an important consideration previously referred to is its "agreement." While milk is very digestible, there is no food material for which persons show such variation in this respect, and it is a mistake to assume that milk is a proper diet for all forms of sickness or for all persons. The proteid of milk is very completely digested, as is also the sugar, but about 5 per cent. of the fat of milk usually escapes digestion. The proteid of milk is more digestible than that derived from other sources. When milk enters the stomach it is speedily curdled by the rennin and acid of the gastric juice. When taken alone or in large quantities the casein is apt to collect in large masses, which will render it more difficult of digestion. Herein is a marked difference between human milk and cows' milk, in that human milk curdles in more flocculent and smaller masses than cows' milk.

The curd in forming entangles the fat globules, but the gastric juice soon dissolves the curd and also the albuminous covering of the fat globules, allowing these to coalesce into large drops which pass on into the intestine with the chyme. Curds which are not fully dissolved by the gastric juice are acted upon by the pancreatic juice after they enter the intestine, where digestion is completed. The salts and water of the milk, and to some extent the sugar, are largely absorbed from the stomach. The usual time for the digestion of milk in the stomach normally is about three hours. When the gastric juice is too acid or organic acids are present in the stomach, the casein is likely to be coagulated into large, firm clots, which resist the solvent action of the gastric juice. When this occurs the clots act

as irritants and may cause vomiting, or, passing into the intestine, they may produce, in like manner, diarrhea. Under such conditions decomposition of the milk sugar may occur with the formation of lactic acid, and the alkaline salts may be split up, complicating the fermentative changes.

Nutritive Value of Milk.—Milk contains the various alimentary substances essential to life in proportions more nearly approximating the needs of the human body than any other single food. Although it is a complete food for infants, it is not suitable as a single food for adults, because the proportion of proteid to carbohydrates is too high; and in order to obtain enough carbon, too much proteid would be ingested, while if only enough proteid were taken, too little carbon would be received. The infant can utilize this excess of proteid, as proportionately more is required for the growing child, which must provide not only for the repair of physiological waste, but also for the adding of tissues for growth, while the adult requires only sufficient to repair the tissues used up by work. The milk necessary to furnish 0.28 pound of proteid required for a man at work would yield only 2700 calories' fuel value, while milk sufficient to furnish the 3500 calories' fuel value necessary for such a man would yield 0.39 pound of proteid. Another reason why milk is not a suitable food alone for adults is that a certain bulk is necessary in the food to stimulate peristalsis. Cows' milk is not a perfect food for infants in its natural form, and must be modified to resemble human milk in order for the best results to be obtained.

Cream.—When the fat globules rise to the surface they entangle a considerable amount of the milk, which is

removed with the fat as cream. Cream, therefore, consists of the fat of the milk with some proteid and carbohydrates. The proportion of the ingredients of the cream is, however, very different from that of milk, the fat being about four and a half times that of milk, while the proteid and carbohydrates are slightly less than in milk. Cream varies somewhat in composition, according to the quality of milk from which it is derived. A good average cream will give the following average proportion:

Water, 66 per cent.; proteid, 2.7 per cent.; fat, 26.7 per cent.; sugar, 2.8 per cent.; salts, 1.8 per cent.

The composition and consistency of cream will further vary according to the manner of its separation. Cream obtained by the most usual method is termed "gravity" cream, as the separation is due to gravity, the heavy milk settling below, while the lighter cream rises to the surface. If cream is warmed to about 100° and the temperature then lowered by placing the pan in cold water, the cream will rise more easily; but unless the milk is in good condition this warming may cause it to sour. This method of separation requires from twelve to twenty-four hours. "Separator" cream is much richer than gravity cream. For this method of separation apparatus is used which, by centrifugal force, drives the heavier milk outward, leaving the cream in the centre, from which it is collected. The advantage of this method of separation over the other is that the cream may be kept longer, as it may be obtained from perfectly fresh milk, and it more completely robs the milk of its fat. It furthermore saves time. Because of its greater richness it is more suitable for certain uses, as whipping. Cream gradually becomes thicker the longer it is kept. When kept to thicken it must be entirely sur-

rounded with ice and kept as near the freezing point as possible.

It will be seen from the analysis that the chief food value of cream is as a source of energy, but it is not an economical food for this purpose.

Skimmed Milk.—In separating the cream from the milk no alteration is made in what remains, which is called "skimmed milk," except the removal of fat, but by its removal the proportion of the ingredients in the skimmed milk is altered, the proteid being relatively greater and the fat tremendously reduced. Some fat always remains after the removal of the cream, the quantity varying according to the method of separation. When separated by the usual method of standing in shallow pans the fat of the skimmed milk will range from 0.37 per cent. to 0.91 per cent., while the separator method will reduce the fat to 0.004 per cent. or less.

Skimmed milk has all the value of whole milk for building and repairing tissues and half the value for supplying energy. Taken alone it is thin and does not satisfy the sense of hunger, as a very large quantity is necessary to supply the needed nourishment, but when taken with other foods it is a valuable and cheap means of supplying proteid. When skimmed milk is used in mixing bread instead of water it considerably increases the nutritive value of bread.

Butter.—This is one of the most digestible of animal fats, and by its pleasant flavor renders many foods more appetizing. In making butter the cream is set aside for many hours in a warm place to sour or ripen. This souring of cream, as the souring of milk, is due to the action of bacteria on the sugar, forming lactic acid. The casein

of cream coagulates and causes it to clot, and the albuminous covering of the fat globules is also coagulated, so that when the cream is churned this covering is easily ruptured, allowing the escape of pure fat.

Among the various kinds of bacteria found in cream a number of species produce a pleasant flavor and aroma during their growth, by the production of volatile acids. The difference in the flavors of butter from different dairies is due to this bacterial action. The bacteria of cream have been studied and several species isolated which will produce known flavors. In some of the large creameries pure cultures of these bacteria are introduced into the cream in order to give it the desired flavor.

All butter contains more or less casein, which is taken up from the milk; the less casein the butter contains, the better is the product. When butter becomes rancid it is due to alteration of the casein through bacterial action. It is, therefore, desirable to rid the butter as completely as possible of the casein, in order that it may keep longer. This is done by thoroughly washing and kneading with water. While this removes the casein quite thoroughly, it also deprives the butter of much of its flavor and freshness by washing out the substances which give it flavor. Sometimes water is purposely left in the butter in order to increase its weight, in which case it may amount to as much as from 20 to 25 per cent. of the weight. Such trickery may be detected by melting the butter, when the water will collect below the fat. Salt is also used to preserve the butter, which it does by checking the decomposition of the casein. Covering butter with water that has been boiled or submerging it in ice-water will help to pre-

serve it. Good butter will give the following approximate analysis:

Fat, 87 per cent.; casein, 0.5 per cent.; sugar, 0.5 per cent.; water, 11.7 per cent.

When perfectly fresh, butter is one of the most easily digested fats. When cooked at a high temperature fatty acids may be developed by the heat and produce irritation of the stomach and cause disease, as does also rancid butter.

Buttermilk.—This is the name given to the milk which remains after the butter has been made and removed. The composition of buttermilk is almost identical with that of skimmed milk, the chief difference in the two foods lying in the fine coagulation of the casein of the buttermilk. This difference renders buttermilk more digestible for many persons than whole milk or skimmed milk, as the finely coagulated casein of the buttermilk is not so apt to form large clots or to be as tough as the casein of skimmed milk or whole milk, which must be coagulated after entering the stomach. Buttermilk is sour to the taste from the lactic acid which is developed in the ripening of the cream before churning. Where cream alone is churned the buttermilk will not be as palatable as when milk and cream are churned without the prior separation of the cream. Buttermilk is a wholesome, digestible food, being equivalent in nutrient value to skimmed milk.

Cheese.—Cheese is composed of the casein of the milk and usually a large proportion of the fat. The milk is coagulated by the addition of rennet and salt is added; the whey is then pressed out, and the curd, after moulding, is put aside to ripen. Ripening is due to bacterial action, and the different flavors of cheeses are due to the action of different

kinds of bacteria which produce fatty acids that give aroma. While the proliferation of the bacteria in milk and cream is a rapid process, their development in cheese is comparatively slow. The proliferation continues for some time, but as the cheese ripens the number and variety of bacteria gradually lessens. This is the occurrence in normally ripened cheese. In abnormally ripened cheese undesirable bacteria develop, causing the formation of gas in large quantity, which makes the cheese unfit for use. The fermentation by these organisms may even go on to the degree of putrefaction.

There are many varieties of cheeses. "Fresh" cheeses, such as cream cheese, are intended to be eaten as soon as made and are not kept. These are usually made from sour milk, and are often called sour cheeses. Other kinds are usually made from sweet milk. The character and quality of cheese largely depend on the amount of fat which it contains. Dry cheese, such as Dutch and Parmesan, are made from skimmed milk. Many cheeses have cream added in their manufacture. These, rich in fat, are the soft, highly flavored cheeses. The dry kinds keep better than the soft. An average percentage of the composition of many of the common cheeses is as follows:

TABLE II. (Davis' Dietetics, after Hutchison.)

Cheese.	Water.	Nitrogenous matter.	Fat.	Ash.
American	26.9	32.9	31.0	4.5
Brie	49.7	18.9	26.8	4.5
Camembert	48.6	21.0	21.7	4.4
Cheddar	31.9	33.4	26.8	3.9
Cheshire	33.2	29.4	30.7	4.3
Cream	32.0	8.6	35.9	1.5
Dutch	32.9	30.8	17.8	6.3
Gloucester	31.9	36.7	24.7	4.4
Gorgonzola	39.2	25.9	29.9	4.7
Grueyère	34.1	31.5	28.2	4.0
Neufchâtel	41.0	14.3	43.2	1.4
Parmesan	30.0	43.8	16.5	5.9
Roquefort	25.1	34.8	31.5	5.5
Stilton	27.6	23.9	38.9	3.1

Cheese is a valuable, nutritious, and economical food, as it contains twice as much nitrogen, weight for weight, as meats. The popular notion that cheese is indigestible is exaggerated. The harder, poorer cheeses which contain a large proportion of casein, are difficult of digestion, but the finer, soft cheeses, which contain a good percentage of fat, are readily digested, at least by normal stomachs. A small quantity of soft cheese, taken after meals in moderation, aids digestion. Taken with milk, cheese tends to reduce the size of the coagula.

Adaptation of Milk for the Sick.—While, as has been stated, milk does not agree with all persons, many are averse to using it through prejudice, though having the power to digest it. Because milk in some form has at a previous time disagreed with anyone, it does not follow that it will of necessity again disagree, if administered with intelligence. Milk should be sipped slowly when taken alone, and never gulped in large quantities, as under such conditions it is liable to form large curds, even in normal stomachs. For those who object to taking milk,

it can be rendered pleasant by altering the taste, by increasing the digestibility in different ways, or by predigesting it.

The taste of milk can be altered by the addition of various flavoring agents. Unless contraindicated by nervous conditions or otherwise, a little coffee or tea added will usually remove the ordinary raw-milk taste and render it palatable. If this cannot be used caramel or a little chocolate or cocoa may be added. Sometimes a pinch of table salt, with or without pepper, is sufficient. Meat extracts or malt extracts are often useful for this purpose. If alcohol is allowable, a little whiskey or brandy may be added with benefit. Many persons who tire of milk may be induced to continue its use when given in the form of ice-cream. Another wholesome milk preparation is oyster stew, in which the milk, flavored with the oysters, is administered.

Methods of Improving the Digestibility of Milk.—Skimming, boiling, dilution with water, with alkaline or aërated waters, with amylaceous foods, the addition of alkalies, acids, or other substances may be employed.

Skimming.—Skimmed milk is more digestible for persons who cannot digest fats. In other respects the digestibility of skimmed milk does not differ from that of whole milk.

Boiling.—By the action of heat the albumin of milk is coagulated and appears on the surface as a scum in which some of the fat globules are entangled. This should be removed before serving. The casein is not coagulated by heat, but boiling causes precipitation of some of the phosphate of lime united with the casein, which renders the curd of the casein, when coagulated by the acids of the stomach, more flocculent and consequently more digestible for some persons. By boiling, bacteria are destroyed

and the growth of other fungi is arrested, thus retarding souring and coagulation. Some of the gases are driven off and some of the water evaporated. The taste of the milk is altered and rendered "flat." This flatness can usually be overcome by pouring the milk through the air or mixing with it a little aërated water.

Whether boiling really increases the digestibility of milk or not is a question, and it would seem that the relative digestibility of raw and boiled milk is a matter of personal idiosyncrasy, some persons being able to digest the raw milk best, while others digest it best after boiling. The albuminous covering of the fat globules is coagulated by the heat, which retards to a large extent the digestion of the fat.

Scalded milk is heated to about 150° by pouring on boiling water. This does not affect its digestibility, except in so far as it is diluted with water.

DILUTION WITH WATER.—By adding plain water to the milk in the proportion of one part to two or three of milk its digestibility can be improved, since such dilution renders the curds smaller and softer. The method is useful where very rich milk is being used.

DILUTION WITH ALKALINE OR AERATED WATER.—Lime-water added to milk renders the curds smaller, partly by the addition of water, partly by the effect of the lime. A mistake is often made in not using the lime-water in a sufficient quantity. From one to four tablespoonfuls should be added to each tumbler of milk. By the increased alkalinity thus attained, acidity of the stomach is counteracted. Lime-water thus used will often control nausea and diarrhea, but is apt to increase constipation. If lime-water is used to neutralize the acidity of cows' milk

it should not be heated above 160° to 170°, as the proteid may be decomposed in boiling the alkaline solution.

Aërated waters, such as alkaline Vichy, bottled soda, or Apollinaris, may be used in any desired quantity. They prevent the formation of large coagula in the stomach, and by aëration render the milk light and palatable and prevent the after-taste so disagreeable to many persons. Hot milk with Vichy will often relieve the irritable cough of bronchitis.

Dilution with Amylaceous Foods.—Any starchy food may be used as a mechanical diluent of milk, as it mingles with the milk, thus preventing the formation of large, tough curds. Bread or crackers are sufficient where they can be taken, and have the additional advantage of requiring to be chewed. Oatmeal-water or barley-water may be used instead of plain water in any desired proportion. Barley-water is better for diarrhea, while oatmeal-water is better for constipation. Flour ball is an excellent preparation for this purpose.

A great number of artificial foods, usually termed "Infant Foods," are offered on the market for the double purpose of modifying the digestibility of milk and adding to its nutritive value. They act as diluents much as do the amylaceous foods, by preventing the coagulation of casein into large curds. Their addition to the food value will vary with their compositions. The following analysis, by Dr. Chittenden, of Yale, of some of the popular preparations will indicate their relative merit in this respect:

TABLE III.—COMPOSITION OF SOME INFANT FOODS AS PREPARED FOR THE NURSING-BOTTLE IN COMPARISON WITH MOTHERS' MILK. PREPARED ACCORDING TO DIRECTIONS FOR INFANTS OF SIX MONTHS.

	Mothers' milk.[1]	Malted milk.	Nestlé's milk food.	Imperial granum.	Mellin's food.	Peptogenic milk powder.
Specific gravity	1031	1025	1024	1025	1031	1032
Water	86.73	92.47	92.76	91.53	88.00	86.03
Total solid matter	13.26	7.43	7.24	8.47	12.00	13.97
Inorganic salts	0.20	0.29	0.13	0.34	0.47	0.26
Total albuminoids	2.00	1.15	0.81	2.15	2.62	2.09
Soluble "	2.00	1.15	0.36	1.67	2.62	2.09
Insoluble "	0	trace	0.45	0.48	0	0
Fat	4.13	0.68	0.36	1.54	2.89	4.38
Milk sugar	6.93	1.18	0.84	2.71	3.25	7.26
Cane "	0	0	2.57	0	0	0
Maltose	0	3.28	trace	trace	2.20	0
Dextrin	0	0.92	} 0.44	} 0.58	0.53	0
Soluble starch	0	0			0	0
Starch	0	0	1.99	1.22	0	0
Reaction	alkaline	alkaline	alkaline	alkaline	alkaline	alkaline

THE ADDITION OF ALKALIES.—In hyperacidity of the stomach the addition of alkalies will counteract the acidity and retard the formation of coagula and render them more flocculent.

Methods of Predigestion.—The object of predigesting the milk is to partially digest the casein so as to relieve the stomach and intestine of some of their work.

PEPTONIZED MILK.—By the addition of pepsin and hydrochloric acid to milk the casein is converted into albumoses. Pepsin added to the milk without hydrochloric acid will not produce this change, as the acid is necessary to render the pepsin active. Numerous peptonizing preparations are on the market which contain both pepsin and acid. One of these should be added in proper quantity to the milk, which must then be placed in warm water and kept at an approximate body tem-

[1] According to Leeds.

perature for a few minutes, when by fermentation the change of the casein into albumoses occurs. If the process is too long continued the milk will have a bitter taste. The fermentation may be checked by raising the temperature of the milk to the boiling point, which destroys the pepsin, or by placing it on ice, which prevents the further action of the pepsin until it is ingested.

PANCREATINIZED MILK.—The use of pancreatin for predigestion has of recent years become more popular than the older method of predigesting by pepsin, as pancreatin is active in an alkaline medium and does not require the addition of acid. The result of the process is similar to that of peptonizing in the conversion of casein into albumoses. To a pint of fresh milk add ½ grain of pancreatic extract and 15 grains of sodium bicarbonate and place in warm water, not boiling, for one-half hour If too long continued the fermentation of pancreatin, like pepsin, will produce a bitter taste, rendering the milk unpalatable. To check the action of pancreatin boil the milk for two or three minutes to stop further fermentation. The milk should then be kept on ice until used. The actual quantity of pancreatin or pepsin used will not make much difference. If an excess is used the process will simply be more rapid, but it is finally checked by the boiling.

KOUMISS.—Milk that has undergone alcoholic fermentation is called koumiss. This method of treating milk is in imitation of certain tribes of Southern Russia, who make an alcoholic drink from mares' milk which they call by this name. In America cows' milk is used for the purpose. Many dairies manufacture it along with other milk products and it is purchasable at many drug stores.

Koumiss has a slightly sour odor and pleasant, bitter taste. During fermentation, alcohol is developed from the milk sugar and may reach a percentage as high as two and a half. Koumiss becomes stronger after keeping a day or two. It decomposes easily. The casein is precipitated and then converted into peptones and propeptones. Unless the fermentation is checked by continued application of extreme cold the product will be constantly changing as fermentation goes on. Spoiled koumiss may produce ptomaïn poisoning. If too fresh, koumiss may cause colic and diarrhea, or if old it may cause constipation. It resembles whey in its diaphoretic and diuretic properties, increasing the solids of the urine. It is usually contraindicated in renal and vascular diseases, gout, and chronic constipation. Koumiss "cures" are established in various parts of Europe. The treatment consists in drinking large amounts of koumiss, with abundant exercise and hygienic methods of living. It is said to be useful in chronic catarrhal conditions and in the first stages of phthisis.

KEFIR.—This is another drink made by the fermentation of milk. It resembles koumiss, but the fermentation is more complete, almost all of the milk sugar being converted into alcohol and carbonic acid gas. The casein is in a large part digested, and what escapes occurs as flocculent coagula.

MATZOON.—This is a preparation very similar to koumiss in its properties and uses.

Sterilization and Pasteurization of Milk.—The object of sterilizing or pasteurizing milk is to destroy hurtful germs which it may contain. For sterilization the milk must be raised to the temperature of boiling water, 212° F., and

kept at this temperature for half an hour. This destroys the harmful bacteria which may be present, but does not destroy the spores from which new bacteria may develop. To make milk practically sterile in the sense of destroying the spores as well as the germs, it is necessary to repeat the operation of sterilization a number of times after sufficient interval has been allowed for the development of bacteria from the spores contained in the milk. This is called fractional sterilization, but it is a tedious and troublesome process and is practically unnecessary, as it has been found that the destruction of living bacteria is sufficient to prevent the development of disease, the spores being destroyed by the digestive ferments before the bacteria can develop from them. In sterilization the milk is placed in bottles and exposed to steam. Various forms of sterilizers are on the market, all of which are made on the same principal—viz., of collecting the condensed steam by a cover to the boiler by which it is returned to the water, thus keeping up a constant current of steam at a temperature of 212° about the bottles. This raises the milk to that temperature, which destroys the living germs. Further effects of sterilization are similar to the effects of boiling milk—viz., the casein coagulates less readily by rennet, and its digestibility is proportionately retarded. The digestion of fat is retarded through toughening of the albuminous covering of the fat globules by the heat, and if the heating is continued too long some of the lactose may be destroyed and converted into caramel. While these changes in the digestibility of milk may not affect normal stomachs, even of children, sick children are very susceptible to even slight changes in the digestibility of the food given them.

For this reason pasteurization of milk has in recent years been more universally used than sterilization. Pasteurization consists in exposing the milk for from ten to twenty minutes to a temperature of 160° to 167° F. If heated above 167°, undesirable changes may be produced. It has been found that if bottles of milk are immersed in water removed from the fire while boiling and allowed to stand twenty minutes, the milk will be uniformly raised to a temperature of 167°. This is, of course, true only where the proportion of the bulk of water used and the bulk of milk to be pasteurized are properly adjusted. Different forms of pasteurizing apparatus are on the market, so adjusted that this relation will be correct, thus rendering pasteurization a simple and easy process. Pasteurization does not affect the rate of digestibility as does sterilization, but it renders the milk practically as safe as sterilized milk. Sterilized milk has the taste of boiled milk, but pasteurized milk, though having this taste mildly while still hot, loses it on being cooled. Sterilized milk will keep longer than pasteurized milk, but it keeps sufficiently long, when pasteurized, for all practical purpose, since a day's supply for a child can be pasteurized at one time and will keep well for twenty-four hours if prepared with proper care. After both sterilization and pasteurization the milk bottles should be stopped with absorbent cotton, which has been baked, and then kept on ice. This protection is essential for safety, since it has been shown by investigations conducted in many laboratories, as to the relative contamination of clean or "certified" milk and pasteurized milk, that bacteria introduced into pasteurized milk multiply far more rapidly than they do in clean milk.

It seems also established that milk drawn from healthy animals under strict aseptic precautions is sterile and that it becomes tainted by handling. As a result of the laboratory investigations a theory has been advanced that fresh milk even destroys some micro-organisms, and has a certain active bactericidal power. Though there is evidence to support this view, it has not been positively determined.

A marked difference in the bacteriology of clean and pasteurized milk has been shown, however, by recent observations in Philadelphia, as reported in July, 1905, by Pennington and McClintoch, of the Bureau of Health of that city, a summary of which is as follows: "During May and June, 1904, contents of clean ('certified') milk and of commercial pasteurized milk showed that the latter was richer in organisms on the initial examination and that a rapid increase in the organisms present took place on keeping, even at refrigerator temperatures.

"Pasteurized modified milk, for infant feeding, showed frequently an appalling initial count and almost invariably a very high count at the end of twenty-four hours.

"The commercial pasteurizing plants succeed in reducing the original bacterial contents of the milk to a very low figure in the heating coils, but again contaminate it in the cooling and bottling of the milk, so that sometimes the final count is higher than that of the original unpasteurized milk."

Modified Milk.—Modern studies in the feeding of infants and the chemistry of milk have led to the establishment of milk laboratories and the production of the so-called modified milk. This simply means that milk is prepared in any given proportion of its ingredients desirable for the

individual. Where modified milk is used, a physician's prescription is written, in which the desired proportions are stated, and it is mixed at the laboratories according to this prescription. In order to prepare modified milk the different ingredients are first separated, the cream being removed entirely by a centrifuge, giving thus pure cream, containing the fat, and pure milk containing proteid, sugar, and salts, but no fat. There is further necessary, for the preparation of modified milk, distilled water, a 20 per cent. solution of milk sugar freshly made with the distilled water, and lime-water. The milk can thus be modified according to prescription in any desired proportion by the addition of water, sugar solution, cream, or lime-water.

Condensed Milk.—This is prepared by slowly evaporating the water of the milk by moderate heat in a vacuum. The consistency is about that of honey. Two varieties are made: the "plain," which is condensed to about one-fourth of its bulk, and superheated, to which no sugar is added or but little; and the "strong" condensed milk, which has cane sugar added in excess to prevent decomposition. Such milk may give from 40 to 75 per cent. sugar. Condensed milk will keep indefinitely while sealed and for several days after opening a can. It is prepared by dissolving in water in any desired proportion. Children thrive on it for a time, and grow fat on the sugar contained, but their flesh is less firm and they have less resistance to disease than children fed on fresh milk. When diluted it rapidly ferments and may cause diarrhea. It should, therefore, be prepared fresh for each feeding.

EGGS.

Hens' eggs are most commonly used for food, but those of guineas, ducks, geese, and turkeys are also often eaten. In some localities eggs of wild birds are valued as a food and are largely consumed.

Eggs are a perfect food in that they contain all of the ingredients necessary to support life, the chicken being fully developed in the shell before hatching. The embryo from which the chicken is developed is situated quite near the yolk, which is first used for nutritive material, the white being reserved for later use after development has progressed. The lime-salts needed for bone formation are furnished by the shell and are dissolved out from the shell by phosphoric acid.

Eggs vary considerably in size with different breeds, but hens of the same breed will usually produce eggs of the same size and appearance. In color they may vary from white to a decided brown shade, and in different localities these different varieties are variously preferred.

Composition.—On an average a hen's egg weighs about two ounces. Of this about 11 per cent. is shell, while the yolk constitutes 32 per cent., and the white 57 per cent. The composition of the white is as follows: Water, 86.2 per cent.; proteid, 12.3 per cent.; fat, 0.2 per cent.; mineral matter, 0.6 per cent. The yolk gives the following analysis: Water, 49.5 per cent.; proteid, 15.7 per cent.; fat, 33.3 per cent.; mineral matter, 1.1 per cent. These percentages are, of course, average percentages, individual eggs varying more or less. Thus it may be seen that the yolk contains considerable fat, almost one-third of its weight, and considerable salts, while the white contains practically no fat, and but very little salts.

TABLE IV.—AVERAGE COMPOSITION OF EGGS AND EGG PRODUCTS.

	Refuse.	Water.	Proteid.	Fat.	Carbo-hydrates.	Ash.	Fuel value per pound.
	%	%	%	%	%	%	Calories.
Hen:							
Whole egg as purchased	11.2	65.5	11.9	9.3	...	0.9	635
" edible portion	...	73.7	13.4	10.5	...	1.0	720
White	...	86.2	12.3	0.2	..	0.6	250
Yolk	...	49.5	15.7	33.3	...	1.1	1705
Whole egg boiled, edible portion	...	73.3	13.2	12.0	...	0.8	765
White-shelled eggs as purchased	10.7	65.6	11.8	10.8	...	0.6	675
Brown-shelled eggs as purchased	10.9	64.8	11.9	11.2	...	0.7	695
Duck:							
Whole egg as purchased	13.7	60.8	12.1	12.5	...	0.8	750
" edible portion	...	70.5	13.3	14.5	...	1.0	860
White	...	87.0	11.1	0.03	...	0.8	210
Yolk	...	45.8	16.8	36.2	...	1.2	1840
Goose:							
Whole egg as purchased	14.2	59.7	12.9	12.3	...	0.9	760
" edible portion	...	69.5	13.8	14.4	...	1.0	865
White	...	86.3	11.6	0.02	...	0.8	215
Yolk	...	44.1	17.3	36.2	...	1.3	1850
Turkey:							
Whole egg as purchased	13.8	63.5	12.2	9.7	...	0.8	635
" edible portion	...	73.7	13.4	11.2	...	0.9	720
White	...	86.7	11.5	0.03	...	0.8	215
Yolk	...	48.3	17.4	32.9	...	1.2	1710
Guinea fowl:							
Whole egg as purchased	16.9	60.5	11.9	9.9	...	0.8	640
" edible portion	...	72.8	13.5	12.0	...	0.9	755
White	...	86.6	11.6	0.03	...	0.8	215
Yolk	...	49.7	16.7	31.8	...	1.2	1655
Plover:							
Whole egg as purchased	9.6	67.3	9.7	10.6	...	0.9	625
" edible portion	...	74.4	10.7	11.7	...	1.0	695
Evaporated hens' eggs	...	6.4	46.9	36.0	7.1	3.6	2525
Egg substitute	...	11.4	73.9	0.3	5.3	9.1	1480

The white of eggs is sometimes supposed to be pure albumin, but it is actually composed of several albumins which are in solution in the water contained; the chief of them, forming the greater part, is ovalbumin. This soluble albumin may be absorbed without previous digestion. The phosphorus in the albumin of egg white is equal to 0.03 per cent. of phosphoric acid. Sodium chloride is the chief salt contained.

The yolk of egg is a more complex substance, the chief

proteid being vitellin. The fats are largely composed of palmitin, stearin, and olein. Other ingredients are a small percentage of coloring matter, with lecithin (a fat-like body containing phosphorus), nuclein, etc., and salts of calcium, magnesium, potassium, and iron. The total phosphorus in the yolk amounts to a little over 1 per cent. of phosphoric acid.

Egg albumin contains sulphur, and the darkening of silver by eggs is due to the formation of silver sulphide. These albumins are readily decomposed with the liberation of hydrogen sulphide and phosphorated hydrogen, which gives the bad odor to rotten eggs. This decomposition is brought about by bacteria which gain access to the egg through minute openings in the shell. It should be remembered that egg-shells are porous, permitting the entrance of bacteria and other substances, and care should therefore be taken to keep eggs under cleanly conditions such as are observed for other foods. A mucilage-like substance coats the outside of the shell, which aids in preventing such contamination. Washing eggs removes this substance, and, while making them more attractive in appearance, renders them more liable to contamination.

Flavor of Eggs.—The fresher the eggs the better the flavor, though perfectly fresh eggs may sometimes have a very unpleasant flavor due to the food eaten by the laying hens. Stale eggs, having the odor of old straw, should never be given to delicate persons.

There are many ways for testing the freshness of eggs. "Candling" is one of the most common methods. Holding the egg between the hands with the candle behind it, the egg will appear unclouded and almost translucent if

fresh, being most translucent at the centre; a stale egg will appear clouded and more translucent at the ends; and rotten eggs appear dark colored.

As eggs grow older their density decreases by the evaporation of moisture. Advantage is taken of this fact to test their freshness. For this method, make a solution of two ounces of salt to one pint of water. A fresh egg gently dropped into the brine will at once sink to the bottom, an egg one day old will sink below the surface but not to the bottom, while one three days old will swim just immersed in the liquid, and if older than that will float on the surface.

Digestibility of Eggs.—There has been much discussion as to the digestibility of eggs cooked by different methods. Recent investigations seem to show that methods of cooking do not affect the total digestibility as much as the time of digestion. Different experiments vary somewhat in the results, but it may be stated as an average that raw eggs are digested in two hours, soft-boiled eggs in three, and hard-boiled eggs in three and one-half to four hours. This refers to digestion in healthy stomachs, since in weak stomachs the white of hard-boiled eggs may remain for several days. Compared with other nitrogenous foods, eggs are readily and thoroughly digestible, as various experiments have shown that from 90 to 95 per cent. of the total proteid and fat are digested. The indigestibility of the white of hard-boiled eggs is largely due to the fact that it is not thoroughly masticated. If thoroughly chewed, it is a question whether there is any marked difference in the time necessary for digestion. The yolk is digested in about the same period of time, whether raw, soft-boiled, or hard-boiled.

Cooking of Eggs.—It has been stated that there are over five hundred different ways in which eggs may be cooked, but these are merely variations or combinations of the simpler methods of cooking described in Chapter III. Different styles of cooking do not to any extent alter the composition of the egg, but produce marked changes in its appearance and texture. The white of egg begins to coagulate at 134° F. At this temperature white fibres appear, which become more numerous as the heat continues, until at about 160° the whole mass is coagulated, opaque in appearance, tender, and of jelly-like consistency. If the temperature is raised to 212° F. (the temperature of boiling water) the albumin becomes coagulated into hard, tough, brittle, and horn-like substance, and also shrinks. The yolk coagulates firmly at a lower temperature than the white.

Boiling.—When eggs are "*soft-boiled*" by dropping into boiling water for two minutes the outer part of the white becomes firmly coagulated, while the yolk remains fluid. A better way to soft boil eggs is to pour a quart of boiling water over two eggs in a bowl and allow them to stand for ten minutes covered with a cloth. Another good way is to place eggs in cold water on the fire, and remove them the instant the water breaks into a boil. By both of these methods the white will be jelly-like in consistency, while the yolk will be firmer.

If an egg be dropped into boiling water and boiled for five minutes, the white will be hardened and the yolk will be more or less gluey in consistency. This is the common way of *hard boiling* an egg. If an egg be cooked longer, however, say from a half-hour to an hour, the yolk will become dry and can easily be broken up into a powder.

Cooked in this way the yolk is very digestible, but the white will be tough. If an egg be kept in water at a temperature of 180° to 190° F. for from a half to three-quarters of an hour the yolk will be dry and mealy and the white tender, though solid.

"SHIRRING" on hot plates is another good way to prepare eggs. The plates should not be too hot or the same effects will be produced as by hard boiling. An excellent way to shirr eggs is to immerse a cup in boiling water until it is thoroughly heated, then, removing the cup, to break an egg into it and allow it to stand for a few minutes.

POACHING.—Poaching is also a good method of cooking eggs. Cooked in this way the shell is broken and the egg dropped into hot or boiling water. The addition of a little salt or vinegar to the water is sometimes recommended, as the vinegar tends to coagulate the albumin and so prevents the solution of some of it in the water.

FRYING.—Fried eggs will make variety in serving, but are not fit for delicate stomachs. *Scrambled* eggs resemble fried eggs as far as the cooking is concerned, the only difference being that the egg is first stirred, the yolk and white being well mixed. *Omelet* is an attractive way of cooking eggs, and, thus prepared, eggs will be lighter and more easily digested than when scrambled if the omelet is well made, but it is, in effect, simply a form of frying. Where eggs are used in combination with other foods, as in the making of custards, etc., with milk, sugar, and butter, the same changes occur which are observed in cooking an egg alone. Such combinations are useful in that these other materials furnish more energy, and make a better balance in the food than egg alone would give, as the proportion of proteid in the egg

is high. In whatever way the egg is cooked, it should be remembered that too great heat coagulates the albumin into a tough substance; the heat should, therefore, be moderate.

Eggs are largely used for making cakes and light breads. Used in this way, they serve instead of yeast or baking powder to make the bread light and porous. When the white is thoroughly whipped, little bubbles of air are caught in the tenacious albumin, making it of a light, frothy consistency. This, when mixed into the batter, renders it light, and on cooking the air bubbles expand, making the bread still more so, while the heat coagulates the albumin, setting the bread so that it will hold its porous character.

The white of egg is often used to clarify coffee, soups, etc., which is accomplished by the enclosing of floating particles in the albumin as it coagulates. The albumin should be mixed with the fluid before boiling. The use of egg-shells for such purpose is not for any effect of their own, but to utilize the white which sticks in the shell after breaking.

Preservation of Eggs.—Various methods of preserving eggs have been tried, the object sought in all being to protect the egg from the entrance of bacteria. Covering in bran, by excluding some of the air, is a helpful means, but not thoroughly efficient. Covering the eggs with lime-water or salt water preserves them fairly well, but this alters the flavor of the egg by absorption through the shell. Coating the egg with vaselin has proven one of the most efficient methods of keeping, but it is tedious. The use of water glass or soluble glass (potassium silicate or sodium silicate) is probably the most effective method of preserving them if the water glass is not very alkaline. It

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is best not to wash the eggs, since this removes the mucilaginous coating. When they have been placed in a suitable vessel a solution of water glass is carefully poured over them. The solution is prepared in sufficient strength by mixing one part of syrup-thick water glass in ten parts, by measure, of water. One gallon of the solution is sufficient for fifty dozen eggs if they are properly packed. Eggs thus preserved will usually crack when boiled. To prevent this a small pin-hole should be made in the end before placing in water. Cold storage has also been used for keeping eggs, and it is a satisfactory method when practicable. Observation differs as to the best temperature, but it should be near the freezing point of water.

Desiccated Eggs and Egg Substitutes.—Desiccated eggs are prepared by evaporating in a vacuum. Sometimes salt or sugar, or both, are used as preservatives. The desiccated egg is usually ground and sold as powder. It contains all of the nutrient materials of the egg, the water only having been removed. This material is used to some extent by bakers when fresh eggs are high in price. It is also useful in expeditions where fresh eggs cannot be procured. After mixing with a small quantity of water, it can be fried or made into an omelet, which is said to be palatable and to closely resemble the similar preparation of fresh eggs.

Various egg substitutes have been devised which are a mixture of fats, albumin, and starch or flour with coloring matter. They are used in making custards and puddings. A substitute made from skimmed milk, said to contain the casein and albumin mixed with flour, is sold in the form of a paste or powder. This is often used by bakers and confectioners and is rich in proteid.

Danger from Eating Eggs.—There are some persons who are always made ill from eating eggs. Such idiosyncrasy is due to the production of poisonous substances during the process of digestion. Overeating of eggs, as with other foods, may induce indigestion. Eggs may be the means of introducing harmful bacteria or parasites into the body. An egg may be infected with disease-producing bacteria either before or after it is laid, when, if eaten raw, the germs will be communicated to man and cause disease. If the hen's feet or feathers have become contaminated with typhoid germs, for instance, they may gain access to the egg if it be allowed to remain in a dirty nest, and so spread disease. Few cases have ever been reported of infection carried by eggs, but many persons have been made ill by eating stale eggs, such illness resembling ptomaïn poisoning, which is caused by waste products produced by the bacteria and not by the bacteria themselves.

CHAPTER V.

PROTEID FOODS (*Continued*). MEATS. FISH.

MEATS.

THE value of meats as food depends upon the proteid and fat which they contain. The proteid is used for building and repairing the tissues, while both are utilized for the development of energy and the maintenance of temperature. Meats are in substance and composition so nearly like the tissues of the human body which they are intended to supply that they have to be but little altered in order to be appropriated; in other words, they are more readily digested than vegetable foods.

Meats consist of the muscle tissue, or "lean," and varying amounts of fat. Besides the fat which is seen in masses, minute invisible particles are distributed throughout the lean of meat.

The lean part of meat of all kinds has practically the same structure. It is composed of prism-shaped bundles, which, if subdivided, will be found to be formed of numerous muscle fibres bound together by thin layers of connective tissue. These muscle fibres are invisible to the naked eye. Their walls are composed of a very delicate elastic membrane of nitrogenous material and are quite permanent, but, in the living animal, their contents are continually undergoing change and renewal.

Toughness or tenderness of meat depends upon the character of the muscle fibres and of the connective tis-

sue which binds them together. In young, well-nourished animals the walls of the fibres are thin and delicate, and the connective tissue is small in amount. Hard work or poor feeding will cause the muscle fibres and connective tissue to become thick and hard. This is the reason why young meat is tender and old meat tough.

Flavor and texture of meat are materially affected by the age of the animal. The flesh of very young animals is tasteless and watery, while that of old animals is apt to be tough. The best beef is obtained from oxen from three to four years of age. A calf should not be killed for veal under six weeks of age, and it is better to wait ten weeks. Hogs may be used at any age after six weeks, but the best product is obtained at the age of eight to twelve months. Three-year-old sheep make the best mutton. It is important in slaughtering animals to see that they are thoroughly bled, as otherwise the meat will have an unattractive red appearance and will not keep so well.

Composition of Meat.—All meat contains water, fat, proteid, a small amount of salts, and very little if any carbohydrates.

WATER.—Meat contains water in varying amount, and the water thus introduced into the body does not differ in its effect from water taken as a beverage. It, however, serves a good purpose in keeping the meat fibre soft, so that it can be more easily masticated and swallowed. The greater the percentage of water in any meat the less will be its relative nutritive value, as it will contain proportionately less nutritive material. The amount of water in meat not only varies in different kinds of meat, but even in different cuts from the same animal. Some cuts contain as little as 50 per cent. of water, while others

contain as high as 75 per cent. As a rule the greater the amount of fat the less will be the amount of water.

FAT.—All meat, even the lean, contains fat distributed in minute particles, invisible to the unaided eye, between the muscle bundles and the muscle fibres. The percentage of fat varies between enormous extremes, from 0.3 per cent. in very lean flesh, such as codfish, to 90 per cent. in fat pork.

Fat is a concentrated food and most useful in supplying heat. Weight for weight it will furnish about two and one-half times the amount of heat that can be obtained from proteid or carbohydrates.

PROTEID.—The proteid of meat consists chiefly in albuminoids and gelatinoids. The albuminoids resemble the white of egg in their properties, while the gelatinoids are similar to gelatin and are converted into gelatin by the action of hot water or steam. The chief value of meats as food depends upon the albuminoids contained. The so-called extractives, thus named because they are easily dissolved out by water, are nitrogenous components of meat, which are formed by the breaking up of albuminoids and possibly of gelatinoids. They consist of creatin and creatinin, substances which resemble theine and caffeine, which are the stimulant ingredients of tea and coffee. They are of little value except in that they give flavor to the meats.

The albuminoids consist of soluble and insoluble albumins, or, in other words, organic and circulating albumins. The most important of the soluble albumins is myosin. This undergoes spontaneous coagulation after the death of the animal, and is further coagulated by cooking. The proteid of meat forms about 20 per cent. of its weight, or

about five times that of milk. The flesh of fowls contains more proteid than does beef, while the flesh of fish has less.

CARBOHYDRATES AND SALTS.—Meat contains only a minute amount of carbohydrates, a fraction of 1 per cent., which is chiefly composed of glycogen. In some of the organs, especially the liver, considerable amounts of this glycogen may be found. Mineral matter occurs chiefly as the phosphates of potassium, calcium, and magnesium in a small amount.

Texture of Meats.—Immediately after slaughtering, meat is soft, juicy, and tender, but in a variable period, from a few minutes to six or eight hours, it stiffens and becomes hard and tough. This condition is known as "rigor mortis," and may last from one to six or seven days. This change is due to the coagulation of the myosin. Following rigor mortis the meat again becomes soft and tender, this change being due to the development of lactic acid, which softens the connective tissue. Meat is not good during rigor mortis, and should be cooked before this occurs, which is generally inconvenient, or else kept until rigor mortis has passed off.

Flavor of Meats.—The flavor depends upon the nitrogenous extractives which the meat contains. Pork and mutton are deficient in extractives, and their flavor depends largely on the fat. Birds and game are rich in extractives, which accounts for their high flavor. As a rule male animals produce more highly flavored meat than the females, the gander, however, being an exception to this rule. The flesh will be more tender, better developed, and more delicately flavored after castration and spaying. The age and food markedly affect the flavor of meats, certain foods giving an unpleasant flavor. Meat,

which is allowed to hang and ripen, during the early stages of decomposition develops compounds similar to the nitrogenous extractives, which add to the flavor of the meat. The flavor of game is greatly increased by decomposition changes, which are often allowed to go so far as to be offensive. All the animal foods used in civilized countries is derived from vegetable-fed animals, the flesh of carnivorous animals being strong and unpleasant. This is true also of animals and birds that feed on fish. The flesh of male animals killed during the breeding season has a gross, unpleasant flavor.

Digestibility of Meat.—Flesh of all kinds, whether raw or cooked, is very completely digested by healthy persons. Where a reasonable amount is taken and excess avoided, nearly all of the proteid and about 95 per cent. of the fats are digested by the average man. Roasted meat is more completely digested than either raw or boiled meat, but raw meat is more easily digested than cooked meat—*i. e.*, the gastric digestion is completed sooner. White meats are usually more tender and contain less fat than other meats, and are more easily and rapidly digested in the stomach. Fat meats take longer to pass from the stomach, probably because the particles of fat coat the proteid, thus retarding the action of the gastric juice. As a rule, the finer the fibre of the meat the more readily it will be digested.

BEEF.—As has been stated, the composition of beef varies with the feeding of the animals, their age, and the cut used. Lean beef will contain about 70 to 75 per cent. of water, 20 per cent. of proteid, and 2 or 3 per cent. of fat; but if the ox be very fat when killed, the percentage of fat may rise as high as 25 per cent., while the water and

proteid will be proportionately reduced. Beef fat is composed of stearic, palmitic, and oleic acids in the proportion of three of stearic and palmitic to one of oleic. It melts at 40° to 50° C.

Fresh beef can be eaten continuously longer than any other meat. The best quality of meat includes rump, sirloin, and fore ribs; the second quality a portion of shoulder, buttock, and middle ribs; the third quality

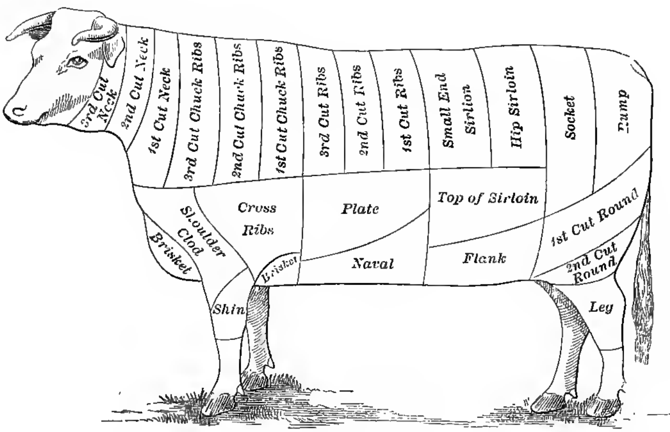

Diagram of cuts of beef.

flank, shoulder, and brisket; the fourth, neck and shin. The flank is usually boiled or braised; the loin is commonly cut into steaks, though it may be roasted. The first steaks from the loin, just in front of the hip-joint, are called sirloin steaks. The next cut from the loin are called the porterhouse steaks, which should contain both the sirloin muscle above the spinous processes and the tenderloin muscle below. These are often erroneously

called tenderloin steaks. The tenderloin is the muscle beneath the loin; this tenderloin muscle when stripped out is used for fillet. The rump is good for pot roast or boiling. The round of beef is usually cut into steaks or may be roasted. The ribs are generally roasted. The shoulder is used for boiling, corning, or mincemeat, other parts for stews, and the shank and neck for soup stock, sausage, etc.

Veal.—If the calf is killed too young the veal will be insipid and watery and unfit for use. Opinions vary as to the digestibility of veal. In America, as in Great Britain, it has been considered less nutritive and digestible than beef, but in Germany it is considered a more digestible food for feeble stomachs than beef. Veal contains more gelatin and more water, but less fat and proteid than beef.

Mutton.—In England mutton is considered a more digestible meat than beef, but the opposite opinion is generally held in America. Though the fibre of mutton is finer and shorter than that of beef, it contains proportionately more fat, which makes it harder to digest. When digested, the nutritive value of mutton is about equal to that of beef. Lean mutton contains about 75 per cent. water, 18 per cent. albuminoids, and 7 to 8 per cent. of fat. The fat of mutton contains a larger percentage of stearic acid than beef fat, which makes it firmer and more difficult to digest.

Lamb.—Lamb, when of the first quality, is about as easily digested as beef or mutton, but it is difficult to obtain it in the right condition, and it contains far too much fat, more than veal. On account of this large fat percentage it is apt to be difficult of digestion.

Venison.—The composition of venison is approximately that of beef, being 74.5 per cent. water, 19.25 per cent. proteid, and 1.3 per cent. of fat. It is short fibred, and, when tender and obtained from young deer, is very digestible and palatable. It is stimulating to the stomach, however, and its gamy flavor makes it unfit for persons of weak digestion.

Pork.—The meat of pork has tender fibres and a pleasant flavor, but it is notoriously indigestible on account of the very high percentage of fat which it contains, the fat even exceeding the amount of proteid. An approximate analysis of lean pork gives water 72.57 per cent., proteid 19.91 per cent., and fat 6.81 per cent., while that of fat pork gives water 47.40 per cent., proteid 14.54 per cent., and fat 37.34 per cent.

Bacon.—Bacon is more digestible than the fat of fresh pork. It contains only a small proportion of water. When cut thin and cooked crisp, bacon is friable and freely broken up in the stomach. It is usually a wholesome form of fat, even for dyspeptics.

Ham.—Ham is very generally used in invalid dietaries in Germany, where it is extolled for its digestibility, both cooked and raw. Such views are not held in America. If the ham has been well cured and thoroughly boiled and is eaten cold, it is a fairly digestible food, but hot ham or twice cooked, fried, for example, is very indigestible.

Besides the flesh of animals various viscera and other parts are used as food, such as bones for soup.

Sweetbread.—True sweetbread is formed of the thymus gland of the calf, but the pancreas is often substituted for it in the market. Sweetbread is tender, pleasant flavored, and easily digested, but the pancreas

is much less digestible. The pancreas can usually be recognized by its coarse bloodvessels. Sweetbread, while useful in many conditions, is largely productive of uric acid.

Brain.—This is of soft consistence and nutritious. It contains a large percentage of fat, however, which makes it difficult to digest by delicate stomachs.

Blood.—It was at one time supposed that fresh blood had special advantage as a food for persons suffering from wasting diseases, and such would be sent to the abattoir to drink the blood warm from the slaughter. This practice did not meet with the expectations of those who adopted it. Besides being repulsive and of unpleasant taste, it is a question whether blood is not difficult of digestion. The blood of pigs mixed with fat and farinaceous foods, like rice, is used as food under the name of blood pudding.

Liver.—The livers of the calf, pig, and lamb are largely used as food. Liver is of close texture and contains a large percentage of fat, and is therefore rather indigestible, though nutritious when digested. Composition of calves' liver is given as follows: water, 72.33 per cent.; proteid, 20.10 per cent.; fat, 5.58 per cent.; carbohydrates, 0.45 per cent.; and salts 1.54 per cent. If liver is cooked too long it will become hard and tough and unfit for use.

Kidneys are of close, firm texture, and, like liver, become hard and tough when much cooked. They are fairly nutritious, but more difficult of digestion than liver.

Heart.—The heart is the same composition chemically as other muscular structures, but is of close texture, which makes it difficult to digest.

Tripe.—Tripe is made from the third stomach of the cow. It is composed of involuntary muscle fibre, which is very tender and easy of digestion, but it contains a large proportion of fat which makes it rich and interferes with its digestion. Its approximate composition is: water, 68 per cent.; proteid, 13.2 per cent.; fat, 16.4 per cent.; and salts, 2.4 per cent.

Poultry and Game Birds.—By the term "poultry" is meant birds domesticated for food purposes. Game birds are those which are reared wild and used for food. Chickens, guinea-fowls, pheasants, and quail belong to the same natural order, and resemble each other in their structure and habits. They differ from other birds in that the color of the flesh of the breast and wings is lighter than that of other parts of the body. Ducks, geese, and swans (swimming birds) have webbed feet; long, thick bills, and dark flesh. Pigeons stand midway between the other two groups in the difference in the color of their breasts and other flesh.

Varieties of Poultry.—Chickens were originally native in Southwestern Asia. The best breeds for table purposes are the light and dark Brahmas; buff, partridge, white, and black Cochins, and black and white Langshans. Good chickens should have a large proportion of flesh relative to the size of the bone, with large, full breast. Chickens with long, thin legs and wings have too little meat relative to the bone. Old cocks are too tough and highly flavored to be good. Capons make the best meat, being very tender, well developed, and having a large proportion of white meat.

Turkeys are natives of North America. Occasional introduction of wild blood in a flock improves the flavor.

Young turkeys do not make as good food as the full-grown bird because they are scrawny and tough.

Guinea-fowls were natives of Africa. They are more used for eggs than for meat, but the young birds and capons are tender, with a partridge-like flavor, while the older birds are more like pheasants in taste.

Pea-fowls were once popular as a food, but are very little used now for table purposes, and are bred chiefly for ornamental birds. They have a large amount of flesh in proportion to their bones.

Pheasants originated in Asia. They are game birds and are considered a great delicacy. The flesh is tender, but has little taste until kept for some time. They should be killed in their first year. The hens are better than the cocks. Many of those now in our markets have been sent from Europe in cold storage.

Quail, frequently called partridges, are delicate and well flavored. Though they are still chiefly game birds, the industry of taming and raising quails for market is growing.

Pigeons.—The flesh of pigeons rapidly toughens after they begin to fly; hence the young birds, called squabs, are usually preferred. They should be killed at about four weeks of age, after they have grown plump and before leaving the nest to fly. They can be procured throughout the year.

Ducks.—The domestic birds are derived from the wild Mallard and are extensively raised in America now for table purposes. Some breeds mature early and are known as spring ducks, the young being ready for market as early as May. Old ducks can be obtained in any season, but are best in the winter.

Geese are used throughout the world for food. They are more popular in Germany than in other countries. They live to great age, but are best for table purposes if killed when three years old at latest. As they grow older the flesh becomes tough and loses its pleasant flavor. "Green geese," half-grown birds, can be had from May until early winter; the old birds all the year.

Swans in olden times were a common food, but are now chiefly bred as ornamental birds. The young birds, called cygnets, are still eaten in England. The flesh is too highly flavored for most tastes.

Choice of Poultry.—In selecting poultry care should be taken to get young birds which are fresh. Though in certain sections and in smaller towns live poultry is still offered in the markets, the marketing of dressed poultry is more common and the practice is growing. A good fresh bird shows a well-rounded form, with neat, compact legs; the breast bone is not angular; the skin should be clear and free from blotches and pin feathers. If the skin looks drawn and tight the bird has probably been scalded before picking. This practice of scalding makes the picking easier, but the birds do not keep as well. Dry-picked birds are to be preferred. The flesh should be firm and yield evenly to pressure, and it should be neither flabby nor stiff.

If the bird is fresh, the feet will be moist, soft, and limber, and the eyes bright and full. Hard, dry feet and shrunken eyes are characteristic of stale birds, while dark greenish spots on the body indicate decomposition. Birds kept in cold storage are usually packed so closely that the wings and legs remain pressed on the body. This squeezed

look is the means of distinguishing between cold-storage birds and fresh.

The age of the bird may be told in several ways. In a young bird the tip of the breast bone, farthest from the head, is easily flexible, but will be brittle in older birds. Sometimes the end of the bone is purposely broken before marketing in order to deceive. The feet of young birds are soft and smooth, but become hard and rough as they grow older. The claws are sharp and short in young birds, but long and blunt in old ones. The spur above the foot is hardly apparent in the young bird; at a few months it is long, but straight, while in old birds it is still larger, but crooked at the end.

The feet of turkeys up to a year old are usually black. They grow pink up to three years old and then turn gray.

The flesh of squabs looks white through the skin, but as the bird grows older it becomes purplish. Old pigeons usually have red feet.

In ducks and geese the windpipe is flexible in the young, and may be squeezed and moved easily, but it becomes rigid and fixed with age.

In young poultry the tips of quills at end of wing are sharply pointed, becoming blunt as the bird grows older.

Cooking of Poultry.—Poultry is cooked by any of the general methods described in Chapter III. For large birds, such as grown chickens, turkeys, etc., roasting and boiling are used, while for smaller birds, such as squabs and quail, broiling is usually better. The loss in cooking poultry is considerably less than that in cooking meats, as the poultry is cooked in its own skin, which prevents the escape of nutritive juices, while with meat large areas of raw surface permit them to escape.

As with other foods, if cooked too long, poultry will be dried up and less digestible, and the same general rule as to the degree of heat required obtains, namely, the smaller the piece the greater the heat and shorter the time. As to the time required, an old rule of cook books for boiling and stewing is "an hour for each year of the bird's age and one for the pot;" of course, the larger the bird the longer the time of cooking. A general rule for roasting chickens and turkeys is twenty minutes to the pound. Ducks and game, being tougher, require a little longer time.

Potted and Canned Poultry.—Before poultry is canned it is first cooked in much the same way as when it is immediately served. It is then sterilized after placing in the cans, and the cans are immediately sealed. If sterilization has been thorough, canned poultry keeps well and is a good food, but imperfect sterilization will lead to decomposition. There is some danger in all canned goods of poisoning from bad tin and solder, but this is not so great with meat as with canned vegetables, which are acid.

Composition of Poultry.—The waste of poultry depends largely upon the person using it, since parts utilized by some persons, as the feet, comb, etc., will be discarded by others. Recent experiments with chickens show the proportion of edible portions and waste to be as follows: dressed and drawn carcass, 66.4 per cent.; giblets 5.5 per cent.; head and feet, 11.2 per cent.; feathers, 8.3 per cent.; entrails, 8.5 per cent. Poultry contains the nutrients common to flesh foods and in proportions not greatly differing from other animal foods.

TABLE V.—AVERAGE COMPOSITION OF POULTRY AND POULTRY PRODUCTS.

Kind of food.	Refuse.	Water.	Proteid.	Fat.	Carbo-hydrates.	Ash.	Heat of combustion per pound.
CHICKENS.	%	%	%	%	%	%	Calories.
Young:							
As purchased	18.8	55.5	17.8	7.2	...	0.9	765
Edible portion	...	68.4	21.9	8.9	...	1.1	945
Meat, not including giblets	...	66.9	22.6	10.1	...	1.1	1000
Dark meat	...	70.1	20.8	8.2	...	1.2	850
Light meat	...	70.3	21.9	7.4	...	1.1	835
Giblets	...	71.0	19.8	6.4	...	1.3	810
Visible fat removed	...	74.5	21.8	2.5	...	1.1	665
Liver	...	69.3	22.4	4.2	2.4	1.7	800
Heart	...	72.0	20.7	5.5	...	1.4	770
Gizzard	...	72.5	24.7	1.4	...	1.4	695
Broiler:							
As purchased	29.1	51.2	15.5	3.3	...	0.8	540
Edible portion	...	69.7	20.7	8.3	...	1.1	890
Meat, not including giblets	...	69.2	21.1	8.8	...	1.1	880
Giblets	...	72.8	18.7	6.1	...	1.3	730
Capon:							
As purchased	17.5	46.8	17.7	17.5	...	1.0	1205
Edible portion	...	56.7	21.5	21.2	...	1.2	1465
Meat, not including giblets	...	55.8	21.6	22.1	...	1.2	1460
Giblets	...	63.3	20.5	14.6	...	1.3	1155
Other:							
As purchased	25.2	47.3	14.4	12.6	...	0.7	910
Edible portion	...	59.5	20.4	19.2	...	1.1	1350
Meat, not including giblets	...	63.4	19.4	16.6	...	1.0	1215
Giblets	...	64.7	18.7	13.7	...	1.3	1070
OTHER FOWL.							
Turkey:							
As purchased	14.3	49.2	19.0	16.2	...	1.0	1185
Edible portion	...	57.4	22.2	18.9	...	1.2	1385
Dark meat	...	57.0	21.4	20.6	...	1.1	1435
Light meat	...	63.9	25.7	9.4	...	1.3	1065
Giblets	...	56.7	17.7	23.5	...	1.2	1480
Dark meat, cooked	...	53.7	39.2	4.3	...	2.2	1200
Light meat, cooked	...	58.5	34.6	4.9	...	1.8	1090
Young, as purchased	32.4	44.7	16.8	5.9	...	0.9	685
Young, edible portion	...	66.1	24.9	8.7	...	1.3	1015
Cooked	...	52.0	27.8	18.4	...	1.2	1505
Heart	...	68.6	16.8	13.2	...	1.0	1000
Liver	...	69.6	22.9	5.2	0.6	1.7	820
Gizzard	...	62.7	20.5	14.5	1.2	1.1	1170
Duck:							
As purchased	15.9	51.4	15.4	16.0	...	1.1	1085
Edible portion	...	61.1	18.3	19.0	...	1.3	1290
Meat, not including breast or giblets	...	55.5	17.4	26.1	...	1.0	1540
Breast	...	73.9	22.3	2.3	...	1.3	685
Giblets	...	73.2	17.9	5.0	...	1.8	720
Duckling:							
As purchased	16.2	43.3	12.0	28.0	...	0.7	1515
Edible portion	...	51.7	14.3	33.4	...	0.9	1805
Meat, not including giblets	...	48.3	13.5	37.9	...	0.7	1950
Giblets	...	70.2	18.9	8.1	...	1.6	835
Green goose:							
As purchased	12.2	41.9	13.6	31.6	...	0.8	1710
Edible portion	...	48.2	15.1	36.0	...	0.9	1940
Meat, not including giblets	...	46.0	15.0	38.3	...	0.8	2030
Giblets	...	68.7	22.3	7.3	...	1.4	995

AVERAGE COMPOSITION OF POULTRY, ETC. (Continued).

Kind of food.	Refuse.	Water.	Proteid.	Fat.	Carbo-hydrates.	Ash.	Heat of combustion per pound.
OTHER FOWL (continued).	%	%	%	%	%	%	Calories.
Goose:							
As purchased	11.1	48.0	14.8	25.5	...	1.0	1475
Edible portion	...	54.0	16.6	28.7	...	1.1	1660
Meat, not including giblets	...	51.8	16.2	31.5	...	1.0	1755
Giblets	...	70.0	20.1	8.2	...	1.7	910
Gizzard	...	73.8	19.6	5.8	...	1.0	750
Liver	...	62.6	16.6	15.9	3.7	1.2	1175
Pigeon:							
As purchased	13.6	55.2	19.7	9.5	...	1.3	915
Edible portion	...	64.0	22.8	11.0	...	1.5	1060
Meat, not including giblets	...	63.2	22.9	12.1	...	1.4	1100
Giblets	...	68.1	22.2	5.2	...	2.3	845
Squabs:							
As purchased	15.6	49.0	15.7	18.6	...	1.3	1205
Edible portion	...	58.0	18.6	22.1	...	1.5	1430
Meat, not including giblets	...	56.6	18.5	23.8	...	1.4	1470
Giblets	...	69.8	19.8	7.2	...	2.0	835
Guinea hen:							
As purchased	16.4	57.7	19.4	5.4	...	1.1	730
Edible portion	...	69.1	23.1	6.5	...	1.3	870
Meat, not including giblets	...	68.9	23.4	6.5	..	1.3	865
Giblets	...	69.9	20.8	7.1	...	1.3	855
Pheasant:							
As purchased	12.0	61.5	21.5	4.2	...	1.0	730
Edible portion	...	69.9	24.4	4.8	...	1.1	830
Meat, not including giblets	...	70.0	24.7	4.6	...	1.1	815
Giblets	...	68.9	20.1	7.2	...	1.6	880
Russian pheasant:							
As purchased	14.1	61.1	21.5	1.9	...	1.2	635
Edible portion	...	71.1	25.0	2.3	...	1.4	740
Meat, not including giblets	...	70.6	25.7	2.3	...	1.4	730
Giblets	...	74.4	21.2	2.2	...	1.3	665
Quail:							
As purchased	10.5	59.0	22.3	6.1	...	1.4	835
Edible portion	...	65.9	25.0	6.8	...	1.6	935
Meat, not including giblets	...	66.3	25.4	7.0	...	1.4	945
Giblets	...	63.0	21.8	6.2	...	2.3	970
PRESERVED POULTRY MEAT.							
Smoked goose breast (including skin and fat)	...	35.7	20.1	38.7	...	5.5	2210
Smoked goose breast (skin and outer fat removed)	...	61.3	26.1	4.4	...	8.0	845
Potted turkey	...	56.0	17.2	22.0	...	3.0	1390
Potted chicken	...	56.1	19.4	20.3	..	2.5	1390
Canned chicken soup	...	87.1	2.9	3.3	5.1	1.6	300
Canned chicken gumbo soup	...	91.0	2.4	0.2	4.8	1.6	160
Canned boned chicken	...	57.6	27.7	12.8	...	2.2	1245
Canned sandwich chicken	...	46.9	20.8	30.0	...	2.6	1825
Canned sandwich turkey	...	47.4	20.7	29.2	...	2.7	1790
Canned quail	...	66.9	21.8	8.0	1.7	1.6	935
Terrine de foie gras	...	41.3	13.6	38.2	4.3	2.6	2075

Digestibility of Poultry.—Poultry, like other animal foods, is very thoroughly digested. A large number of experiments show the average digestibility to be: proteid, 97 per cent.; fat, 95 per cent.; and carbohydrates, 98 per cent.

Nutrient Value.—Poultry contains less water than beef, but more than eggs or cheese; usually more fat than milk or eggs, but less than butter, lard, etc.

As regards different kinds of poultry, birds with light-colored flesh are richer in proteid and poorer in fat than the others. In light-fleshed varieties young birds yield more proteid and less fat than old ones, while in dark-fleshed birds the reverse is true. As a rule young birds contain less refuse, or, in other words, the proportion of their flesh to bone is greater than in old ones.

Concerning the comparative value of white meats and red meats opinions differ, some authorities considering the white meats more readily digestible, while others make no distinction.

As to the relative nutritive value of light and dark meat from the same bird it is probable that the difference is insignificant except for persons of very feeble digestion. The white meat contains less fat than the dark, and so may be better digested by delicate stomachs, but experiments made of late with normal persons failed to show any difference between the two.

With regard to the use of poultry in dietaries the purse must usually decide. Cheap chickens in city markets are about as good for food and about the same cost as the less desirable cuts of meats, but chickens and turkeys of good quality are quite as expensive as the choice cuts of meat. Game birds are luxuries and can only be afforded by the well-to-do.

FISH.

Fish form a large part of food for man. Fresh-water and salt-water fish are equally wholesome, and preference of one over the other is a matter of individual taste. The value of fish depends upon many conditions, but all fish are better when eaten in season, as their food supply at other times does not make as palatable meat. Fish from cold, deep waters or from rocky or sandy bottoms are much better than those from warm, shallow waters or muddy bottoms. All fish are best just before spawning, as after spawning they lose fat and become poor and flabby. Young fish, which have not reached the spawning age, may be eaten at any time.

The manner of capture affects the quality of fish. When caught in the gills by nets and allowed to die slowly the quality of their meat is inferior and they undergo decomposition easily. Fish should be eaten as soon after capture as possible, and are best when killed immediately on landing. The practice of shipping fish long distances in cold storage or on ice, while usually safe when properly done, may lead to trouble, as the cold prevents evidence of decomposition which may have begun to a dangerous extent.

Composition and Digestibility of Fish.—The composition of the meat of fish is very similar to that of animal meats. It varies greatly with the varieties, as also with different specimens of the same variety. The chief variation is in the amount of fat contained. Those containing a large percentage of fat have less water and usually slightly less proteid. The total digestibility of fish is about equal to that of lean meat, 97 per cent. of the proteid and over 90

per cent. of the fat being retained by the body. Salt fish is less thoroughly digested than fresh fish. As to the rate of digestion of fish as compared to that of meat there seems to be still some uncertainty. Experiments made by the U. S. Department of Agriculture seem to show that fish is less quickly digested than beef, though Yeo states that it is more quickly digested, which explains the fact that fish is less satisfying as well as less stimulating than meats. Fish containing a high percentage of fat are more difficult of digestion than lean fish. Fish may be divided for convenience into three classes, based on their contents of fat. The first class, containing over 5 per cent. of fat, includes salmon, shad, herring, Spanish mackerel, and butter fish; the second, containing from 2 to 5 per cent. of fat, includes white fish, mackerel, mullet, halibut, and porgy; the third class, containing less than 2 per cent. of fat, includes smelt, black bass, blue fish, white perch, weak fish, brook trout, hake, flounder, yellow perch, pike, pickerel, sea bass, cod, and haddock.

TABLE VI.—COMPOSITION OF FISH, MOLLUSKS, CRUSTACEANS, ETC.

Kind of food material.	Refuse (bone, skin, etc.)	Salt.	Water.	Proteid.	Fat.	Carbo-hydrates.	Mineral matter.	Total nutrients.	Fuel value per pound.
FRESH FISH.	%	%	%	%	%	%	%	%	Calories.
Alewife, whole	49.5	...	37.5	9.7	2.5	...	0.8	13.0	285
Bass, large-mouthed black, dressed	46.7	...	41.9	10.3	0.5	...	0.6	11.4	215
Bass, large-mouthed black, whole	56.0	...	34.6	8.5	0.4	...	0.5	9.4	175
Bass, small-mouthed black, dressed	46.4	...	40.1	11.5	1.3	...	0.7	13.5	270
Bass, small-mouthed black, whole	53.6	...	34.7	10.0	1.1	...	0.6	11.7	230
Bass, sea, dressed	46.8	...	42.2	10.1	0.2	...	0.7	11.0	195
Bass, sea, whole	56.1	...	34.8	8.3	0.2	...	0.6	9.1	160
Bass, striped, dressed	51.2	...	37.4	8.7	2.2	...	0.5	11.4	255
Blackfish, dressed	55.7	...	35.0	8.3	0.5	...	0.5	9.3	175
Bluefish, dressed	48.6	...	40.3	9.8	0.6	...	0.7	11.1	205
Butterfish, dressed	34.6	...	45.8	11.7	7.2	...	0.7	19.6	520
Butterfish, whole	42.8	...	40.1	10.2	6.3	...	0.6	17.1	455
Carp (European analysis)	37.1	...	48.4	12.9	0.7	...	0.9	14.5	270
Cod, dressed	29.9	...	58.5	10.6	0.2	...	0.8	11.6	205
Cod, steaks	9.2	...	72.4	16.9	0.5	...	1.0	18.4	335
Cusk, dressed	40.3	...	49.0	10.1	0.1	...	0.5	10.7	190
Eel, saltwater, dressed	20.2	...	57.2	14.6	7.2	...	0.8	22.6	575
Flounder, common, dressed	57.0	...	35.8	6.3	0.3	...	0.6	7.2	130
Flounder, winter, dressed	56.2	...	37.0	6.1	0.2	...	0.5	6.8	120
Hake, dressed	52.5	...	39.5	7.2	0.3	...	0.5	8.0	145
Haddock, dressed	51.0	...	40.0	8.2	0.2	...	0.6	9.0	160
Halibut, dressed	17.7	...	61.9	15.1	4.4	...	0.9	20.4	465
Herring, whole	46.0	...	37.3	10.0	5.9	...	0.8	16.7	435
Mackerel, dressed	40.7	...	43.7	11.4	3.5	...	0.7	15.6	360
Mackerel, Spanish, dressed	24.4	...	51.4	15.8	7.2	...	1.2	24.2	595
Mackerel, Spanish, whole	34.6	...	44.5	13.7	6.2	...	1.0	20.9	515
Mullet, dressed	49.0	...	38.2	9.8	2.4	...	0.6	12.8	285
Mullet, whole	57.9	...	31.5	8.1	2.0	...	0.5	10.6	235
Perch, white, dressed	54.6	...	34.4	8.7	1.8	...	0.5	11.0	235
Perch, white, whole	62.5	...	28.4	7.2	1.5	...	0.4	9.1	195
Perch, yellow, dressed	35.1	...	50.7	12.6	0.7	...	0.9	14.2	265
Pickerel, dressed	35.9	...	51.1	11.9	0.2	...	0.9	13.0	230
Pickerel, whole	47.1	...	42.2	9.8	0.2	...	0.7	10.7	190
Pike, dressed	30.5	...	55.4	13.0	0.4	...	0.7	14.1	260
Pike, whole	42.7	...	45.7	10.7	0.3	...	0.6	11.6	210
Pollock, dressed	28.5	...	54.3	15.5	0.6	...	1.1	17.2	315
Pompano, dressed	45.5	...	39.5	10.2	4.3	...	0.5	15.0	370
Porgy, dressed	53.7	...	34.6	8.6	2.4	...	0.7	11.7	260
Porgy, whole	60.0	...	29.9	7.4	2.1	...	0.6	10.1	225
Red grouper, dressed	55.9	...	35.0	8.4	0.2	...	0.5	9.1	165
Red snapper, dressed	48.9	...	40.3	9.6	0.6	...	0.6	10.8	205
Salmon, California (sections)	5.2	...	60.3	16.5	17.0	...	1.0	34.5	1025
Salmon, Maine, dressed	23.8	...	51.2	14.6	9.5	...	0.9	25.0	675
Shad, dressed	43.9	...	39.6	10.3	5.4	...	0.8	16.5	420
Shad, whole	50.1	...	35.2	9.2	4.8	...	0.7	14.7	375
Shad, roe	...	...	71.2	23.4	3.8	...	1.6	28.8	595
Smelt, whole	41.9	...	46.1	10.0	1.0	...	1.0	12.0	230
Sturgeon, dressed	14.4	...	67.4	15.4	1.6	...	1.2	18.2	355
Tomcod, dressed	51.4	...	39.6	8.2	0.3	...	0.5	9.0	165
Tomcod, whole	59.9	...	32.7	6.8	0.2	...	0.4	7.4	135
Trout, brook, dressed	37.9	...	48.4	11.7	1.3	...	0.7	13.7	275
Trout, brook, whole	48.1	...	40.4	9.8	1.1	...	0.6	11.5	230
Trout, lake, dressed	35.2	...	45.0	12.4	6.6	...	0.8	19.8	510
Turbot, dressed	39.5	...	43.1	7.9	8.7	...	0.8	17.4	515
Turbot, whole	47.7	...	37.3	6.8	7.5	...	0.7	15.0	440

Composition of Fish, Mollusks, Crustaceans, etc. (Continued).

Kind of food material.	Refuse (bone, skin, etc.)	Salt.	Water.	Proteid.	Fat.	Carbo-hydrates.	Mineral matter.	Total nutrients.	Fuel value per pound.
FRESH FISH (continued).	%	%	%	%	%	%	%	%	Calories.
Weakfish, dressed	41.7	...	46.1	10.2	1.3	...	0.7	12.2	245
Weakfish, whole	51.9	...	38.0	8.4	1.1	...	0.6	10.1	200
Whitefish, dressed	43.6	...	39.4	12.5	3.6	...	0.9	17.0	385
Whitefish, whole	53.5	...	32.5	10.3	3.0	...	0.7	14.0	320
General average of fresh fish as sold	42.0	...	44.0	10.5	2.5	...	1.0	14.0	300
PRESERVED FISH.									
Mackerel, "No. 1," salted	33.3	7.1	28.1	14.7	15.1	...	1.7	31.5	910
Cod, salted and dried	24.9	17.2	40.3	16.0	0.4	...	1.2	17.6	315
Cod, "boneless codfish," salted and dried	...	21.5	54.4	22.1	0.3	...	1.7	24.1	425
Caviare	...	...	38.1	30.0	19.7	7.6	4.6	61.9	1530
Herring, salted, smoked, and dried	44.4	6.5	19.2	20.2	8.8	...	0.9	29.9	45
Haddock, "finnan haddie," salted, smoked, and dried	32.2	1.4	49.2	16.1	0.1	...	1.0	17.2	305
Halibut, salted, smoked, and dried	6.9	12.1	46.0	19.1	14.0	...	1.9	35.0	945
Sardines, canned	5.0	...	53.6	24.0	12.1	...	5.3	41.4	955
Salmon, canned	3.9	1.0	59.3	19.3	15.3	...	1.2	35.8	1005
Mackerel, canned	...	1.9	68.2	19.9	8.7	...	1.3	29.9	735
Mackerel, salt, canned	19.7	8.3	34.8	13.8	21.3	...	2.1	37.2	1155
Tunny (horse-mackerel), canned	...	...	72.7	21.5	4.1	...	1.7	27.3	575
Haddock, smoked, canned	...	5.6	68.7	21.8	2.3	...	1.6	25.7	505
MOLLUSKS.									
Oysters, solids	...	...	88.3	6.1	1.4	3.3	0.9	11.7	235
Oysters, in shell	82.3	...	15.4	1.1	0.2	0.6	0.4	2.3	40
Oysters, canned	...	...	85.3	7.4	2.1	3.9	1.3	14.7	300
Scallops	...	...	80.3	14.7	0.2	3.4	1.4	19.7	345
Long clams, in shell	43.6	...	48.4	4.8	0.6	1.1	1.5	8.0	135
Long clams, canned	...	...	84.5	9.0	1.3	2.9	2.3	15.5	275
Round clams, removed from shell	...	...	80.8	10.6	1.1	5.2	2.3	19.2	340
Round clams, in shell	68.3	...	27.3	2.1	0.1	1.3	0.9	4.4	65
Round clams, canned	...	...	83.0	10.4	0.8	3.0	2.8	17.0	285
Mussels	49.3	...	42.7	4.4	0.5	2.1	1.0	8.0	140
General average of mollusks exclusive of canned	60.2	...	34.0	3.2	0.4	1.3	0.9	5.8	100
CRUSTACEANS.									
Lobster, in shell	62.1	...	31.1	5.5	0.7	...	0.6	6.8	130
Lobster, canned	...	...	77.8	18.1	1.1	0.6	2.4	22.2	395
Crawfish, in shell	87.7	...	10.0	2.0	0.1	0.1	0.1	2.3	45
Crab, in shell	55.8	...	34.1	7.3	0.9	0.5	1.4	10.1	185
Crab, canned	...	...	80.0	15.8	1.5	0.8	1.9	20.0	370
Shrimp, canned	...	...	70.8	25.4	1.0	0.2	2.6	29.2	520
General average of crustaceans (exclusive of canned)	73.7	...	20.9	4.3	0.4	0.2	0.5	5.4	100
TERRAPIN, TURTLE, ETC.									
Terrapin, in shell	79.0	...	15.6	4.5	0.7	...	0.2	5.4	115
Green turtle, in shell	76.0	...	19.1	4.5	0.1	...	0.3	4.9	90
Average of turtle and terrapin	77.5	...	17.4	4.2	0.7	...	0.2	5.1	105
Frogs' legs	32.0	...	57.0	10.2	0.1	...	0.7	11.0	210
General average of fish, mollusks, crustaceans, etc.	44.0	...	42.5	10.0	2.5	0.1	0.9	13.5	295

The old theory that fish was especially useful as a brain food because of the phosphorus contained is now exploded. As a matter of fact, fish does not contain as much phosphorus as some meats. It is, however, a good form of nitrogenous food for persons leading a sedentary life.

Large quantities of fish are dried, salted, or smoked for preservation. Such curing modifies their flavor and renders them less digestible. Fish are also canned, being first heated and sealed in air-tight tins. When this is done by modern processes, the original flavor is largely retained, and they usually keep well. Some canned fish are cooked and canned in their own juices; others, such as sardines, are canned in oil.

Various kinds of fish extracts and juices are put up and preserved to be used as relishes; some of them, like anchovy, in the form of pastes; while others, like clam juice, are liquid. The use of preservatives, such as salicylate of soda, is harmful if used to any great extent.

The roe of many fish is considered a delicacy. The hard roe is derived from the female and the soft roe or milt from the male. The nutritive value of roe is not very high, but it gives variety and increases appetite. The roes of different fish vary as to digestibility, according to the species from which they are derived and the manner of preparation. Thus, shad roe is quite digestible, while caviar, which is a salted sturgeon roe, much used as an appetizer, is more difficult of digestion and often retards the digestion of other foods.

While fish is usually a wholesome food, it must always be remembered that it cannot be eaten by some persons, in whom, even when fresh, it produces disturbances of the alimentary tract, such as nausea, diarrhea, or cramps.

In others it invariably causes urticaria, an itching skin eruption.

Cooking of Fish.—Fish is usually boiled, steamed, fried, or baked. In cooking there is a loss of weight of from 5 to 30 per cent., which consists chiefly of water. There is little loss in the fat or proteid. Fish is a frequent ingredient of made dishes, such as chowders, salads, etc.

Shell Fish.—Under this general name are included oysters, clams, mussels, lobsters, crabs, crawfish, shrimp, and prawns. Of these, the most important, as it is the most generally used, is the oyster. This fish is nutritive and of special value for its delicate flavor. Oysters are more nearly like milk as to the amount and proportions of their nutrients than any other common food material. Roughly speaking, a quart of oysters contains about the same amount of nutritive substances as a quart of milk or three-fourths pound of beef or a pound of bread. The nutritive value of oysters varies with their variety and with different specimens of the same variety.

Because of the large amount of shell in oysters, the percentage of refuse is very high as compared with other food materials; so that they are rather an expensive food for the nutrients obtainable from them. Their value, however, is great for the variety which they make in a diet, and such a variety is often worth as much or more than actual nutrients.

Oysters decompose readily after being shucked, and are better in the cold winter months. An old rule that oysters are good only in the months whose names contain the letter "R" is a safe rule to follow; but on the sea coast, where they are served soon after being taken from their beds, oysters may be eaten the year round.

It is a common custom among oystermen to place oysters in fresh water for twenty-four to forty-eight hours before marketing in order to "fatten" them. This procedure is called "floating" or "laying out." Thus treated the oyster acquires a plumpness which improves its appearance and increases its size and weight, and of course adds to its market value. Sometimes the water used for this purpose is first warmed. This "fattening" is not, however, a gain in flesh or fat, as the increase in size and weight is due to the absorption of water. At the same time, there is a loss of nutrients amounting to from one-eighth to one-fifth. Oysters may be treated thus either by placing them in fresh water while in the shell or by adding fresh water after they have been shucked. Many persons prefer the flavor of the "fattened" oysters, even at the cost of loss of nutrient material. It is also believed that oysters keep better when some of the salts have thus been removed by "floating." When "floated" alive—*i. e.*, in the shell—the oyster does not live as long, the rate of decay increasing rapidly and the life period being reduced one-half.

Oysters are sometimes marketed which are more or less green in color, the color being especially prominent in the gills, from which they are termed in some localities "green-gill oysters." This color has been attributed to disease, to parasites, and to copper, but it is due to green plants on which the oysters have fed, the coloring matter of which, being soluble in the oyster juices, tinges the tissues. This coloring matter is harmless, and in Europe and some localities of America green oysters are prized. The color may be removed by placing the oyster a few days in water that is free from these plants.

Oysters are very readily digestible, especially the soft part, which consists chiefly of the liver. The hard, circular portion is the muscle which holds the two shells together, and is more difficult to digest. Especially is this true after cooking, as the coagulation produced by heat makes this muscle or "heart," as it is called, tough and indigestible. This should always be removed when oysters are administered to invalids.

Oysters are most digestible when raw. They may be cooked by stewing, broiling, or steaming, and if not overcooked they are very digestible when thus prepared. Fried oysters, while popular, are far less digestible and should never be given to persons of delicate digestion.

CLAMS are a popular sea food, but not nearly so extensively used as oysters. In nutrients they do not differ materially from oysters, but the flesh is tougher. Their flavor is agreeable and they are much used for making broths. Both clams and oysters are forbidden diabetics on account of the glycogen contained in their livers. Clam juice, either freshly prepared or bottled, is mildly stimulating to the stomach, slightly nutritive, and laxative. In some forms of vomiting it is almost a specific. It is now marketed bottled, which is convenient and safe, as it keeps indefinitely when well prepared.

MUSSELS are usually cooked in their own liquor, with the addition of condiments. They are somewhat dangerous between May and September, as severe ptomaïn poisoning has frequently been produced by them.

LOBSTERS, CRABS, SHRIMPS, AND CRAWFISH contain a fairly large percentage of nutrients. Except in their native places these foods must be looked on as a delicacy. Though nutritious foods with pleasant flavors, they should

never be given to invalids. Their meat is good, but they are scavengers of the sea, and unless great care is taken in cleaning them there is danger of poisoning.

The lobster is more delicate and more digestible than the crab. The flesh of the claws is more tender than that of the tail, which is true also of the crab. Soft-shell crabs give a large amount of indigestible residue which, unless the shell be literally soft, is the cause of the illness not uncommonly produced by this food.

Shrimp are appetizing and stimulating to the stomach, making a variety and giving pleasant flavor to the diet.

Turtle and terrapin are much used in the United States, but the supply is relatively small; hence they are expensive delicacies. Analysis shows them to be nutritious foods, though, as they are usually prepared for the table with high seasoning, they are apt to be indigestible, and not infrequently cause derangement of the digestive functions.

Idiosyncrasy for shell fish is more common than for any other kinds of fish, and many persons are invariably made ill by partaking of them.

Frogs, though amphibian, may be mentioned here, as they have of late years become popular as a delicacy. The flesh is tender and pleasantly flavored. Only the hind legs are used, as the flesh on the rest of the body is scant. When properly cooked frog legs make a pleasant variety in the diet. Their flavor resembles delicate chicken.

CHAPTER VI.

PROTEID FOODS (*Continued*). CEREALS. PEAS, BEANS, AND LENTILS. PEANUTS.

VEGETABLE PROTEIDS.

CEREALS.

CEREALS are found universally the world over, and their seed have formed a food for man from time immemorial. They are a condensed food, as a large amount of nutritive material is held in a small space. They contain a good percentage of proteid with starch and cellulose, and variable amounts of gum, sugar, and fat. They also contain a good percentage of salts, chiefly in the form of phosphates. All cereals contain a sheath or coating of cellulose, which must be removed or broken before the grain is fit food for man, for, though it is readily digested by many animals, the human gastric juice cannot digest cellulose. Cereals are prepared for food by breaking the grain coarsely, and in this form their use is familiar as cereal breakfast food. The more important manner of preparation is by grinding to flour for the purpose of bread-making. The chief cereals are wheat, barley, oats, rye, corn or maise, and rice.

Wheat.—Of all the cereals used for food, wheat is the most important, as it is more universally used and most largely consumed. Wheat grain is a small, oval seed, covered by a skin consisting of several layers of cellulose, beneath which is a membrane that forms the real sheath of the seed proper. Then comes a layer made up of cells

filled with a nitrogenous substance known as cerealin. These several layers, which form about 13 per cent. of the weight of the whole grain, constitute the bran. The larger part of the interior of the seed is called the "endosperm," and consists of irregular cells filled with starch granules. At the lower end of the seed, adjacent to the endosperm, lies the germ. When the ripe grain is planted this germ develops into a new plant, material for its growth being furnished by the substances of the endosperm until it is sufficiently advanced to draw its nutriment directly from the earth.

Composition.—Besides cerealin, the bran also contains quite a large proportion of phosphoric acid and potash, with smaller amounts of other minerals. The endosperm contains the cellulose of its cell walls, large quantities of starch, some sugar, and a good proportion of nitrogenous material known as gluten. The germ, besides cellulose, contains nitrogenous substance, sugar, and a large proportion of fat. The amount of water contained by the grain will vary with atmospheric conditions, as it will take up water in a damp atmosphere and lose it in a dry climate. The amount of moisture will vary also with the character of the season during which the wheat is grown. On an average, water forms from 12 to 13 per cent. of the total weight of grain. While the inner layer of bran is proportionately the richest part of the wheat in nitrogenous material, the greatest actual amount of this is found in the gluten of the endosperm. The amount varies in different wheats. "Hard" wheats are rich in gluten, which is strong and tenacious, while "soft" wheats contain less gluten and more starch. The more gluten contained, the larger will be the yield of bread for a given amount of

flour. Flours containing less gluten have a milder and more agreeable flavor, however. The most important part of wheat for flour making is the endosperm, which contains the gluten and starch. The bran, if left in the flour, makes it dark, and it is questionable if the cerealin of the bran is well digested by the human stomach. The fibrous portion is not only undigested by the human stomach, but may act as an irritant to the delicate mucous membrane of the alimentary tract. The germ, if left in the flour, tends to darken it, though the fat contained is a valuable food. It is, however, liable to become rancid and spoil the taste of the flour. The more gluten contained, the more water will the flour take up in making the dough. Flours are, therefore, classified as "strong" or "weak" according to the proportion of gluten which they contain. Gluten ranks as an easily digested proteid, and therefore has much nutritive value.

The preparation of flour from the grain is accomplished by milling. The older method is by grinding between stones. The objection to this method is that the flour is not so fine, and of necessity contains dust formed from the substance of the stone as it wears away by attrition. The modern method of milling is the so-called patent-roller process. By this method the grain is passed through a series of steel rollers, each pair being set a little more closely than the preceding. After each grinding the flour is sifted and the leavings, called "tailings," are again ground and sifted.

Flours are made to contain varying portions of the grain. Graham flour contains the entire grain. After washing and cleaning, the grain is completely crushed between stones or rollers. Entire wheat flour or whole

wheat flour, sometimes called "decorticated" flour, is made similarly, except that the outer fibrous layers of the bran are first removed, the inner layers containing the cerealin being retained. The high-grade patent flours are prepared as entire wheat flours, the products of the different portions of the grain being removed by successive rolling and sifting, so that flour may be obtained consisting simply of the endosperm. Straight-grade flours consist of the siftings of all of the grindings, with the first product of the first tailings added. "Patent flours" are variations of the straight-grade flours. Grades are produced as desired by mixing various flours in the mill, these themselves being frequently mixed by bakers and further varieties obtained.

The usual yield from wheat is about 80 per cent. of flour, 16 per cent. of bran, and 4 per cent. of loss.

Various complicated tests are used in mills in grading flours, but simple means of judging are as follows: the color should be white or faintly tinged with yellow; after being squeezed in the hand it should fall apart; if it stays in lumps after squeezing it has too much moisture; when rubbed between the fingers it should not be too smooth and powdery, but its individual particles should be vaguely perceptible; when placed between the teeth it should "crunch" a little; its taste should be sweet and nutty, without a suggestion of acidity.

Impurities in flour are produced by the incorporation of other seed or by blighted or moulded wheat. The seed which should be especially guarded against are cockels and darnels, though all foreign seed should be removed before grinding. Cockels injure the color of the flour, while darnel is regarded as poisonous.

Blighted or moulded wheat will give a musty odor and taste to the flour. Adulterants are added to flour to cheapen its cost or improve its appearance. Rye flour, cornmeal, ricemeal, potato starch, and meal made from peas and beans are added to cheapen the product. While these are not injurious, their addition is fraudulent, as they lessen its nutritive value. Mineral substances, such as alum, borax, or chalk, are sometimes added to flour to whiten it. Such adulterations are injurious to health.

Rye.—Rye is in general similar in structure to wheat, but its outer coating is darker and it makes, therefore, darker flour. The most important difference between rye and wheat is in the character of its gluten, which lacks the elastic, tenacious quality of the gluten of wheat. Consequently bread made from rye flour is heavier and does not rise as well. Though rye flour contains a larger percentage of proteid than wheat flour, the consistency of bread made from it renders it less digestible; hence its nutritive value is not greater than that of wheat. Bread made from it is dark in color, and is therefore often spoken of as "black bread." It is sour-tasting and often disagrees with persons who are not accustomed to it. It is much used, however, on the continent of Europe. Rye flour is often mixed with wheat flour in making bread.

Barley and Oats.—These cereals are rarely used for bread, as the gluten is even less tenacious than that of rye, which makes the bread heavy and indigestible. In structure the grains are very similar to wheat. The percentage of water in them is less than in wheat, while the bran forms 21 per cent. of barley and 44 per cent. of oats. Flours made from them contain a high proportion of nutritive materials, but the large amount of cellulose

contained renders them indigestible and unsuitable for bread-making.

Corn or Maize.—The grain, known in America as Indian corn, but in Europe called maize, is a highly nutritious grain. Compared with wheat it is richer in fat, poorer in cellulose and proteid, and nearly equal in carbohydrates and water. The fat is chiefly contained in the germ, which is often removed in milling to prevent rancidity. Cornmeal contains no tenacious proteid like gluten, and therefore does not make a light loaf with yeast. It is, however, appetizing in unleavened bread, such as hoe-cakes. When made up with egg and milk into the so-called batter-bread, commonly used in the Southern States, it makes a delicious and digestible food preparation.

Rice.—This grain, though the staple article of diet with many Eastern peoples, has much less nutritive value than the preceding. It is relatively poor in proteid, the amount of which varies from 3 to 7½ per cent. It is also poor in fats and salts, its chief ingredient being starch, and it contains very little cellulose; hence as a starchy food it is readily digestible and of great value. Because of its scant proteid and fat, it is not suitable as a single food. As marketed, the husk has been removed with the inner cuticle or red skin which covers the grain. Used alone, rice cannot be made into bread, but it is often mixed with wheat flour or cornmeal in making cakes of various kinds. Boiling removes some of the proteid and salts; it should therefore be steamed when cooked alone.

Millet and **buckwheat** are used in some of the Eastern countries instead of the cereals preceding. They do not make good bread, however, but are mixed with wheat flour and made into cakes, or eaten in the form of porridge.

The relative composition of cereals is shown in the following table:

TABLE VII.—COMPOSITION OF CEREALS.

	Water.	Proteid.	Fat.	Carbohydrates.		Ash.
				Starch, etc.	Crude fibre.	
	%	%	%	%	%	%
Barley	10.9	12.4	1.8	69.8	2.7	2.4
Buckweat	12.6	10.0	2.2	64.5	8.7	2.0
Corn (maize)	9.3	9.9	2.8	74.9	1.4	1.5
Kafir corn	16.8	6.6	3.8	69.5	1.1	2.2
Oats	11.0	11.8	5.0	59.7	9.5	3.0
Rice	12.4	7.4	0.4	79.2	0.2	0.4
Rye	11.6	10.6	1.7	72.0	1.7	1.9
Wheat:						
Spring varieties	10.4	12.5	2.2	71.2	1.8	1.9
Winter varieties	10.5	11.8	2.1	72.0	1.8	1.8

Cereal Breakfast Foods.—A great variety of breakfast foods are now in the market. Most of them are made from wheat and oats, though some are prepared from rice, corn, or barley. Many of the preparations are similar in appearance, and though their nutritive worth is practically identical, their prices vary greatly. The utmost variety occurs in the names used as trade names, but there is very little difference in the nutritive value of those made from the same kind of grain. In almost all of them the outer covering or the husk is first removed, and the remainder of the seed ground, rolled, or crushed. Some of them are first partially cooked, usually by steaming; a few are parched. Though some of them are claimed to be quick-cooking preparations, most of the cereal foods require cooking for at least half an hour to ensure digestion of the starch, and softening of the fibre which is found in them all to a greater or less degree.

TABLE VIII.—COMPOSITION OF CEREAL BREAKFAST FOODS.

	Water.	Proteid.	Fat.	Carbohydrates (including crude fibre).	Crude fibre.	Ash.
Corn:	%	%	%	%	%	%
Flaked (average of 5 analyses)	10.3	9.6	1.1	78.3	(0.4)	0.7
Hominy (average of 17 analyses)	11.8	8.3	0.6	79.0	(0.9)	0.3
Parched (average of 2 analyses)	5.2	11.5	8.4	72.3	...	2.6
Oats:						
Oatmeal (average of 16 analyses)	7.3	16.1	7.2	67.5	(0.9)	1.9
Rolled oats (average of 20 analyses)	7.7	16.7	7.3	66.2	(1.3)	2.1
Miscellaneous preparations with different trade names (avarage of 26 analyses)	7.9	16.3	7.3	66.8	(0.9)	1.7
Rice: Flaked (average of 2 analyses)	9.5	7.9	0.4	81.9	(0.2)	0.3
Wheat:						
Cracked and crushed (average of 11 analyses)	10.1	11.1	1.7	75.5	(1.7)	1.6
Flaked (average of 7 analyses)	8.7	13.4	1.4	74.3	(1.8)	2.2
Germ preparations (average of 10 analyses)	10.4	10.5	2.0	76.0	(0.9)	1.1
Gluten preparations (average of 3 analyses)	8.9	13.6	1.7	74.6	(1.3)	1.2
Parched and toasted (average of 6 analyses)	8.6	13.6	2.4	74.5	(0.8)	0.9
Shredded (average of 6 analyses)	8.1	10.5	1.4	77.9	(1.7)	2.1

Cereal foods have a high food value, though the claim that they are more nutritious than flour is probably fallacious, as all experiments seem to show that flour furnishes the greatest amount of proteid at the least cost. These foods are palatable and wholesome and usually agree well. They are good for children, but too much sugar should not be eaten with them as this will cover the flavor. As far as the nutritive value is concerned, the different cereal foods vary according to the grain from which they are made, and different preparations made from the same kind of grain apparently vary with the different crops of the grain used. In the oat food, proteid is the most variable constituent, while in corn and rice products the amount of water is most variable. As far

as the phosphorus contained in cereals is concerned, the percentage of this substance varies practically only with the kind of grain used, there being little difference in the percentage of it in different foods made from the same grain. It should be remembered, by those who have to economize, that cereal foods bought in bulk are just as nutritious as those bought in packages. The only advantage of the package preparations is that they are convenient, and apt to be more uniform. The price of such preparations is, of course, higher than when sold in bulk.

Bread.—One of the most important processes of cooking or preparation of food, is, undoubtedly, the making of bread. When flour is mixed with water and other materials, a tenacious, sticky substance called dough is formed. If thus eaten, it is not only unpalatable, but remains in masses that cannot be divided by chewing, and being therefore impervious to the digestive fluids, it escapes their action and produces disturbances in the digestive processes. It is necessary to reduce this dough mass to a form that will be penetrable by the digestive fluids, which is accomplished by rendering it porous. This is done by different methods: (1) fermentation by yeast, (2) fermentation by leaven, (3) by chemicals, and (4) by aëration.

Fermentation by Yeast.—Yeast is a microscopic plant which grows rapidly when certain proper conditions, namely, food, warmth, and moisture exist in combination. Yeast is universal throughout the world. Substances such as malt, potatoes, or hops if exposed to the air will develop this fermentation; this is called wild yeast. The old Egyptian custom of making yeast was to expose dough to wild yeast and then use a little of this dough for making more. The cultivation of yeast with

potato is still common in some parts of the country. Brewers' and distillers' yeasts are taken from the vats after the fermentation of malt extract. "Scotch barms" are made with the scum that rises to the top in beer-making. Compressed yeast, now so generally used in this country, is made by growing yeast plants in some sweet liquid and then drying, with a little starch added in some cases to keep the shape of the cakes. Yeast is very susceptible to atmospheric changes, but compressed yeast, when well made, is more uniform than any other. When yeast is introduced into a suitable medium for its growth and proliferates, it uses up some of the sugar for its own growth, and from this forms carbonic acid gas and alcohol. But the development of this gas is not limited simply to the materials used for food by the yeast plant; the process is extended throughout the substance of the dough. This gas, developing in minute bubbles, is held by the tenacious and sticky gluten of the flour which prevents its escape. The mass of dough, therefore, enlarges, the bulk being doubled or trebled. It is this dissemination of gas throughout the dough that makes bread porous and fit for use. The more gluten the flour contains, the more yeast can be used and the greater will be the yield of bread from a given amount of dough. The process of bread-making with yeast consists of kneading, soaking or rising, and baking.

Kneading.—When the dough is made, the yeast must be thoroughly mixed with it by kneading in order to distribute it uniformly throughout the dough. Kneading is performed by most cooks with the bare hands, as the bread cannot be properly worked with a spoon. While this method may be satisfactory for making a small

quantity of dough, it should not be used where a large amount, which requires some time to knead, is to be made, but a kneading machine should be used instead. This should be done to prevent the entrance of impurities into bread through the sweat, which cannot be wiped off while the hands are in the dough. If kneading is not properly done, the yeast will be present in some parts and absent from other parts of the dough, and the bread when cooked will be of uneven porosity. The part in which the yeast was present will have large gas bubbles, which make holes in the bread; while the part from which the yeast was absent will be solid and tough. When the dough is properly kneaded, the bread after baking will show a uniformity in the distribution of the tiny holes in it.

Yeast is used in two ways, and according to the method of its use the dough is termed straight dough or sponge dough. In making straight dough all of the ingredients for the dough are mixed and kneaded at once. This requires more yeast and stronger flour than the other method and makes a dough that is stiff and hard to knead, and the bread thus made has a coarser texture. Sponge dough is made by first mixing the yeast with a part of the flour and water to form a "sponge." Instead of flour, boiled potatoes are sometimes used for making sponge. This is set aside for eight to ten hours to rise; the rest of the flour is then thoroughly kneaded into it, and this dough set aside for a shorter time, say two or three hours, before baking. As a sponge contains more moisture than a straight dough, the yeast has a better opportunity to work. Sponge dough rises evenly and bread thus made keeps well.

Soaking or Rising.—As has been stated, it is necessary for the development of yeast to have a combination of food, moisture, and warmth. The food and moisture exist in the dough, but the warmth must also be provided. This may be done partially by using warm water for mixing the dough, but, after kneading, the dough must be placed in a warm place—*i. e.*, at a temperature of 77° to 95° F.—and allowed to stand for eight to ten hours for the development of the yeast with the production of the desirable carbonic acid gas. If too little yeast is used the bread will be heavy, as the gas developed will not be sufficient to make it porous. If too much yeast is used, the gas developed will accumulate in large bubbles and make so great pressure as to burst through the restraining gluten and escape. When this occurs the bread will be heavy and sodden. If the gas does not actually escape, it may accumulate, forming large holes in the dough. Such dough is called "overproved," and if it is again kneaded a little before putting into the oven, the excess of gas may be removed.

Baking.—After the bread has risen, it is placed in a hot oven. The heat causes the bubbles of gas to expand, making the bread more porous than the dough, and drives off this gas together with the alcohol and some of the water. By the coagulation of the gluten the bread is "set"—*i. e.*, it becomes stiffened and fixed, so that it retains its porous form and does not collapse after removal from the oven. Large holes seen in the substance of the bread indicate imperfect kneading. If these large holes occur just beneath the crust, it shows that the heat was too great. The oven is usually heated to 400° or 500° F. When the dough is first put in, the yeast continues to

work until the temperature of the bread has reached 158° F., at which temperature it is killed. Heating of the starch causes the coating of the granules to rupture.

The outer surface of the dough receives the greatest amount of heat, which changes the starch into a stiff gum and sugar, evaporates the water, and thus forms the crust. The brown color is due to the conversion of sugar into caramel. If the oven is too hot, the crust will form rapidly before the interior is sufficiently cooked, preventing the escape of the gas, which will burst through, making holes. The dough is frequently moistened on the surface to prevent the too rapid formation of crust, or steam is passed over it for this purpose. As in the cooking of meats, so with bread, the larger the piece, the lower should be the temperature for cooking. A pound loaf will usually bake in an hour and a quarter, while small rolls are done in half an hour. The larger the loaf, the smaller will be the percentage of crust.

The cooling of bread should be carefully attended to, to ensure good results. After the bread is taken from the oven, water and gas continue to pass from it until it is cooled. When the bread is immediately placed on plates, evaporation from the surface on which it rests is prevented, and if the plate be cold there will be a tendency to condensation of the water of this surface, with the result that the crust of this part will be sodden and wet. The practice of wrapping hot bread in cloths immediately on removal from the oven is likewise unadvisable, for the reason that it makes the loaf damp and clammy. Such bread is apt to become mouldy. To be properly cooled, bread should be placed in wire racks or on slats in order that the air may circulate freely about it on all sides.

Fermentation by Leaven.—This method of making bread is of interest to-day chiefly from its historical association, being the method used from the earliest times to modern times. Its use is still practised in some modern countries. Leaven is simply old dough that has been fermented, which is put aside, mixed with a little flour and water, until the whole mass is fermented, when it is ready to be used in making new bread. The usual manner of making leaven is to take off a little of the dough before the bread is baked and use it to start the fermentation for the next supply. Methods of preparing dough with leaven are similar to those described in making bread with yeast. Bread made with leaven usually has an acid taste, and does not keep as well as that made with yeast.

Chemicals.—While yeast makes the best-flavored bread, the labor of making and the time necessary for rising are so great as to invite more rapid and simple methods of preparation, and so-called yeast powders or baking powders have been introduced, the use of which is now common in America. The principle of their action is that in combining an acid and alkali, gas is developed, rendering the bread porous, as does the gas developed by yeast. The first yeast powder used was formed of acid calcium phosphate with bicarbonate of sodium and potassium chloride. This was mixed with the flour, and when water was added these chemicals combined, developing gas. Many baking powders are now on the market under a variety of names. Good baking powder should consist simply of soda and cream of tartar. It is claimed that bread made with baking powders is not only quicker in the making, but is lighter. It lacks, however, the pleasant flavor that good yeast gives, and is of questionable whole-

someness on account of its introduction of drugs into the stomach. Where cream of tartar and soda are used no harm is done, but when ammonium carbonate or alum is a constituent of the powder, continued use will be hurtful. Baking powders are easily and frequently adulterated with materials injurious to health.

Aëration.—This method of making bread is popular in London. Carbonic acid gas is made by the action of sulphuric acid on marble dust, just as it is prepared for soda-water fountains in this country, and is introduced into the dough under pressure. Water charged with the gas is used for wetting the dough, which is mixed in a special apparatus. About one cubic foot of gas is used for fourteen pounds of flour, but at least one-half of this escapes from the dough. This bread is light and porous and keeps better than bread made by other methods, and it is claimed that malfermentation does not occur. It has a peculiar flavor which is liked by many persons, and it dries much more quickly than other breads.

Unleavened bread has been used by the Jews in celebration of the Passover since the time of Moses. It is simply flour and water baked into small cakes until dry and hard. Other forms of unleavened bread in general use are ship's biscuit and various kinds of crackers. These are made with flour and water; with milk, butter or lard, and various flavoring materials. The dough is then quickly baked in a hot oven.

Varieties of Bread.—A great variety in the appearance and taste of bread made from the same kind of flour can be obtained, by varying the manner of mixing the dough or of baking. The general principles of making are such as have been described, and the nutritive value of the

product will vary according to the materials added to the flour. Fancy breads are made with the addition of milk, eggs, fat, and sometimes sugar. Bread made of cornmeal is apt to be hard and heavy when made by the ordinary method. When mixed, however, with milk and eggs into a batter and baked in a pan (the so-called batter bread, egg bread, or spoon bread common in the Southern States), it is easily digested and nutritious. For this purpose meal of white corn should be used, as the yellow corn does not give as good a result. The manner of grinding corn very materially affects the character of bread made from this meal. Country ground, or water ground, meal is the best. When ground fine and bolted, as is done in the large city mills, it makes a bread of very close texture, which is harder to digest and less pleasantly flavored than the unbolted meal.

Graham bread is bread made from the entire grain of wheat and includes the bran. This bread was introduced with the idea that it was more nutritious because, by the retention of the bran, its valuable proteid and phosphates were added to the food, thus increasing its nutritive value. While it is true that this bread contains by chemical analysis more nutritive material than white bread, it is a question whether the proteid of the bran is well digested in the human stomach. It is known that the cellulose of the bran itself is not digested in the human stomach; so it is not certain that the nutrients of the bran are to any extent utilized by the body. Furthermore, the bran is an irritant to the mucous membrane of the digestive tract. In some instances this irritation may occur to the extent of real interference with the digestive process, but even where this does not occur it does increase peristalsis so that the

food is carried more rapidly through the intestines, allowing less time for absorption. These objections to Graham bread led to the production of the so-called "entire" or "whole wheat" bread, in which the outer layers of the grain were removed before grinding. Recent experiments have been conducted by the United States Department of Agriculture to determine the percentage of digestible nutrients contained in different breads, the amount of proteid digested, and the proportion of fat and salts utilized. The results of these experiments show that white bread yields the highest percentage of valuable nutrients, next the entire wheat, and last Graham bread. The same order was found to obtain in regard to the amount of proteid digested, and of fats and salts utilized. In view of the results of these experiments and the fact that the whole wheat and Graham flours are more expensive, the advantage lies with the white flours. The difference in nutritive value of various grades of white flour is very slight. In certain conditions, however, as constipation, in which a greater bulk of waste in the intestines is desirable for the purpose of stimulating peristalsis, Graham bread is peculiarly useful.

Stale Bread.—The old idea that stale bread differs from fresh bread simply in the drying out of some of the water contained is not exactly correct. Recent experiments show that the difference in the amount of water in fresh and stale bread is not great, and that the chief difference between stale and fresh bread is in the distribution of the water. In good fresh bread the crust is crisp and breaks with a snap, while the crumb is elastic and springs back into shape after being gently pressed with the finger. In stale bread the crust is softer and tougher, bending rather

than snapping, while the crumb seems dry and is friable. The explanation of this is that the hard crust cools more quickly than the soft crumb, and as the bread grows stale the water tends to pass from the crumb into the crust. This fact is verified on heating stale bread, when the crust will be found again crisp, while the crumb becomes more moist. Stale bread heated over, however, will be drier than fresh bread, as some of the water in the crust is evaporated. Stale bread is more easily digested than fresh bread because of the greater friability of the crumb, which permits more thorough incorporation of the digestive fluids with it.

Toast.—Good toast should always be made of stale bread and the slices should be cut thin. Toasting should be done quickly over hot coals in order to convert the surface rapidly into caramel, which then appears as a brown, fragrant coating. When bread is burnt in toasting, the carbohydrates are converted into carbon instead of caramel. When the slices are too thick, the interior of the toast will be moist and sodden and difficult to digest. This is due to the absorption of water into the interior of the slice, which is driven from the surface by the heat. When a thin slice is toasted too slowly, the toast will be hard and brittle from the drying out of the whole slice before the surface is converted into caramel.

Hot Bread.—There is a popular theory that hot bread is indigestible. The heat does not affect the digestibility however, but in fresh bread, made in large loaves, it will be found that the crumb when squeezed will remain in more or less solid masses. Such bread will, of course, be less readily digested than the friable stale bread. This condition is avoided when bread has been allowed to cool

and water has been lost by evaporation while cooling. Bread thus cooled and dried can then be reheated without affecting the digestibility. When hot bread is baked in small pieces, such as rolls, in which the proportion of crust is largely in excess of the crumb, these objections have less weight, as there is little difficulty in masticating the crust.

TABLE IX.—COMPOSITION OF VARIOUS BREADS.

	Number of analyses.	Water.	Proteid.	Fat.	Carbo-hydrates.	Ash.
		%	%	%	%	%
Corn bread (johnnycake)	5	38.9	7.9	4.7	46.3	2.2
Rye bread	21	35.7	9.0	0.6	53.2	1.5
" and wheat bread	1	35.3	11.9	0.3	51.5	1.0
Wheat bread "gluten"	6	38.2	9.3	1.4	49.8	1.3
" " "Graham"	27	35.7	8.9	1.8	52.1	1.5
" " "rolls"	20	29.2	8.9	4.1	56.7	1.1
" " from high-grade patent flour	...	32.9	8.7	1.4	56.5	0.5
" " from regular patent flour	...	34.1	9.0	1.3	54.9	0.7
" " from bakers' flour	...	39.1	10.6	1.2	48.3	0.9
" " from low-grade flour	...	40.7	12.6	1.1	44.3	1.3
" " average, all analyses	198	35.3	9.2	1.3	53.1	1.1
Whole wheat bread	12	38.4	9.7	0.9	49.7	1.3
Crackers	71	6.8	10.7	8.8	71.9	1.8

Imperfections and Impurities in Bread.—Sodden or heavy bread is indigestible. Several conditions may produce it, such as the use of too much water in proportion to the amount of flour, the use of too little yeast, poor kneading so that the yeast is not thoroughly mixed, or insufficient cooking. This, when chewed, instead of breaking up into smaller particles, will roll into solid lumps, which resist the action of the digestive fluids.

In damp weather mould may form in bread. This is a minute plant, the seeds of which float about everywhere in the air and may find lodgement in bread when it is

exposed in damp places. The best plan for protection against mould is to keep the bread in an air-tight box.

Sour bread is always due to the action of bacteria which form lactic and butyric acid; but the sources of the bacteria may vary. Sometimes these bacteria may be in the flour from which the bread is made. In such cases the bread will usually be sour whenever made from such flour. If the vessels in which the bread is made are not perfectly clean, they may get into the dough from them. Or the bacteria may be in the yeast itself. If rising or fermentation be then too long continued, so that the fermentation ceases naturally, these bacteria will grow with the production of acid. Sometimes bread sours on keeping, in which case it is contaminated by bacteria from the air.

Adulterants are frequently added to bread by bakers for the purpose of giving it a better appearance. Various substances are used for this purpose, chiefly alum. Alum whitens the bread and enables it to take up more water. Its use is injurious to the digestive system. It can be detected by soaking a sample of the suspected bread in a solution of tincture of logwood and ammonium carbonate, when, if alum be present, a bluish color will appear. Copper sulphate is sometimes used for similar purposes, but its use is dangerous. Lime will produce the same effects and is not in itself harmful, but the practice is reprehensible, in that it gives poor bread the appearance of good. Soda is used to prevent souring, but this is not injurious, and in breads made with flours which are poor in gluten, such as oatmeal, barley, etc., it is necessary in order to produce a sweet, good loaf.

PEAS, BEANS, AND LENTILS.

These foods, collectively spoken of as legumes or pulses, occur in great variety. They are eaten both ripe and green and some of the latter are used with their pods.

Unlike other vegetables, they contain a large percentage of proteid. When fresh they do not differ markedly from other green vegetables, but when dried their content of proteid is high, in some instances even exceeding that of meat, as is shown in the following table:

TABLE X.—COMPOSITION OF FRESH AND DRIED LEGUMES.

Material.	Water.	Proteid.	Fat.	Carbo-hydrates.	Ash.	Fuel value per pound
	%	%	%	%	%	Calories.
Fresh legumes:						
String beans	89.2	2.3	0.3	7.4	0.8	195
Whole pods of *Dolichos sesquipedalis*	79.9	4.5	0.5	13.9	1.2	365
Sugar peas or string peas	81.8	3.4	0.4	13.7	0.7	335
Shelled kidney beans	58.9	9.4	0.6	29.1	2.0	740
Lima beans	68.5	7.1	0.7	22.0	1.7	570
Peas	74.6	7.0	0.5	16.9	1.0	465
Cowpeas	65.9	9.4	0.6	22.7	1.4	620
Canned string beans	93.7	1.1	0.1	3.8	1.3	95
" Lima beans	79.5	4.0	0.3	14.6	1.6	360
" kidney beans	72.7	7.0	0.2	18.5	1.6	480
" peas	85.3	3.6	0.2	9.8	1.1	255
" baked beans	68.9	6.9	2.5	19.6	2.1	600
Peanut butter	2.1	29.3	46.5	17.1	5.0	2825
Dried legumes:						
Lima beans	10.4	18.1	1.5	65.9	4.1	1625
Navy beans	12.6	22.5	1.8	59.6	3.5	1605
Frijoles	7.5	21.9	1.3	65.1	4.2	1695
Lentils	8.4	25.7	1.0	59.2	5.7	1620
Dried peas	9.5	24.6	1.0	62.0	2.9	1655
Cowpeas	13.0	21.4	1.4	60.8	3.4	1590
Soy beans	10.8	34.0	16.8	33.7	4.7	1970
Chick-pea	14.8	12.4	6.7	63.3	2.8	1690
Peanuts	9.2	25.8	38.6	24.4	2.0	2560
St. John's bread (carob bean)	15.0	5.9	1.3	75.3	2.5	1565

The proteid is chiefly legumin, which is so much like the casein of milk that it has been called "vegetable casein." It is precipitated by rennet and acid, but not by

heat. Although the proteid percentage is so high, the legumes are not as valuable as meat, since the legumin is not as digestible. This is due to the fact that the nutrients are enclosed in cells of cellulose, which interferes with their intimate contact with the digestive fluids, and the cellulose itself acts as an irritant, increasing peristalsis. This lessens the time for complete digestion and absorption, an effect further increased by fermentation to which vegetable foods are prone. Legumes are often considered indigestible because they produce flatulence, if eaten in quantity. Many experiments have been made with beans or peas as the sole or chief article of diet to determine their digestibility, which show that the manner of cooking greatly affects this. When simply boiled with the skins, as is the usual custom, about 40 per cent. of the proteid is lost in the feces, but when ground into meal and made into purées, only 8 to 10 per cent. escapes. When they are eaten with other foods, an average of 85 per cent. of the proteid is absorbed.

The removal of the skins by long soaking in water materially lessens the production of flatulence. Eaten in moderate quantities with other foods, legumes are digestible by persons having light muscular exercise, and for out-door workmen they may contribute a large proportion of the diet. Persons of sedentary habits are not apt to digest them well, as their nutrients differ in character from the corresponding nutrients of cereals.

Preparation.—**String beans** or **snaps** and **sugar peas** are eaten fresh with their pods. They should be gathered very young, when the beans have but recently formed, and before they become "stringy." The pods are cooked either whole or broken. They should be boiled in salt

water for twenty to forty minutes, which is long enough to make them tender if they are gathered young enough to be fit for use. Bacon is often boiled with them and adds to their flavor, but for many persons it renders them less digestible. After parboiling they may be stewed and seasoned in other ways. String beans may be salted and kept for many months. Fermentation then occurs, much as in making saur kraut, which softens the fibre and develops a flavor which many persons find agreeable.

Shelled beans and **green peas** should be cooked as soon after gathering as possible, since delay increases the time necessary for properly cooking them. Stewing is the best method of cooking, and they are better if well seasoned with butter and condiments when they are half done. They should be cooked only until tender, as prolonged cooking changes their color. Canned beans and peas have the same composition as those freshly cooked, but lack flavor.

Dried legumes are staple articles of food, and if fat is added they form a complete food, supplying the substances necessary for life in good proportion. Beans of good quality should have smooth skins, not wrinkled, and should be of uniform size. Large beans present the advantage of having a smaller proportion of skin than small ones, but some small varieties are preferred because their skins are very thin and delicate.

The essential quality is that beans should cook well—*i. e.*, that their cellulose should be softened so as to liberate the nutrients for the action of the gastric juice, and that the starch granules burst, releasing the starch.

The skin of dried legumes is very tough and quite indigestible. The usual practice of soaking beans and

peas overnight is a sensible one, as it causes the beans to swell and softens the skin. If well stirred after soaking, the skins of many kinds of beans and peas can be separated and will rise to float on the surface of the water, when they can be readily skimmed off. The beans are then boiled and served with the consistency of mashed potato, or thereafter they may be further cooked in other ways.

Legumes should be cooked if possible in distilled water or rain water, since by the use of "hard" water for boiling some of the salts of the water are absorbed and form insoluble compounds with the legumin which no amount of cooking will soften. Boiling with soda added to the water in the proportion of half a teaspoonful to two quarts assists in softening the skins and increases the digestibility of beans and peas, but the flavor is apt to be injured.

After boiling to soften them, legumes are cooked in other ways, very commonly by baking, with the addition of various materials, such as herbs, molasses, or pork, to improve their flavor. Pork does more than this, however, as its addition supplies the fat needed to make peas and beans a well-balanced food. Finely ground legumes form the basis of many soup tablets and other forms of condensed food useful for armies on the march, explorers, etc. "Pea sausage" is the name of a preparation of pea and lentil flour, cooked and mixed with bacon, which proved of great value to the German troops for emergencies in the Franco-Prussian War, though its continued use produces digestive disturbances.

PEANUTS.

Though generally considered a nut, and as such used as an accessory to diet rather than as a vegetable, the peanut is, in fact, a legume, and is one of the richest of them in proteid, containing more than 25 per cent. of it. Carbohydrates, which in other legumes form the greater part of their nutrients, is in the peanut largely replaced by fat, of which it contains nearly 39 per cent.

In spite of its high nutrient value, as shown by analysis, it has never become a staple article of diet even among the poor in the Southern States, where it is easily raised. The few experiments that have been conducted to determine its digestibility indicate that it is probably a digestible food when taken with other articles, though many persons are made sick by too free indulgence in this palatable pea. This disagreement may often be prevented by eating a little bread with them.

The peanut when roasted and ground forms an oily meal which is called peanut butter from its consistency. It is used in various made dishes and for sandwiches.

Various grades of oil are produced from the peanut, the best of which is excellent for table use. The oil cake which remains after the oil has been expressed is used for fattening cattle. Its high percentage of nutrients, 47 of proteid and 9 of fat and carbohydrates, has suggested its possible usefulness as a cheap food for man. A few experiments have been made with it, after prolonged boiling, in the form of porridge or soup, and it was taken with apparent relish and without early satiety, though the degree of its digestibility has not been determined.

CHAPTER VII.

CARBOHYDRATE FOODS AND SALTS. VEGETABLES. FRUITS. CONDIMENTS.

Carbohydrates, so-called because they contain hydrogen and oxygen in the proportion to form water, include starch, cellulose, and sugar. Except for sugar of milk and glycogen, the animal starch found in livers, this class of food is supplied entirely by the vegetable kingdom.

Starch is insoluble, and occurs in vegetables and cereals as granules, enclosed in minute cells whose envelope is composed of cellulose. Starch derived from different sources varies only in the physical character of its granules. When heated in the presence of moisture the granules absorb water, which causes them to swell and rupture the cellulose envelope, becoming thus liberated to the action of the digestive fluids. Without this rupture of the cell envelope the digestion of starch would be much retarded, as cellulose is unaffected by the saliva or gastric juice, and is slowly acted upon by the pancreatic juice. Dry heat converts starch into dextrin, which is soluble. As stated in Chapter I., the food value of starch lies in its ready oxidation with the production of heat and energy. Its digestibility is enhanced if it is eaten with butter or some other good form of fat, as this prevents the starch from forming impermeable lumps in the stomach.

Cellulose, like starch, is an insoluble carbohydrate. Except when very young and tender it is indigestible. It

occurs in all vegetable foods, contributing largely to their bulk, and forms the framework for the support of the vegetable cells. It is very susceptible to the action of certain micro-organisms found in the alimentary tract, which results in the formation of marsh gas, an irritant substance which may cause inflammation of the mucous membrane of the stomach and intestines. Hence, persons with weak digestion, whose resistance to the entrance of micro-organisms is diminished, are apt to be distressed by excessive gas formation when they partake largely of vegetable foods.

Sugars are crystallizable carbohydrates. They are derived from various vegetable sources in which they occur in solution in the juices, and in one form from milk. They differ in ease of crystallization, in the degree of sweetness, and in their readiness to undergo fermentation. The most familiar form of sugar is cane sugar or sucrose, which is derived from the juice of the sugar cane and from the sugar beet. Other forms of sugar which are ingested with food are grape sugar, milk sugar, fruit sugar, and maple sugar, which is a cane sugar obtained from the sap of the sugar-maple tree and possessing a peculiar, pleasant flavor due to ethers.

Cane sugar, the common sugar of commerce, is subjected to the elaborate process of refining before it is marketed, and is practically a pure sugar. The supply of cane and beets is so plentiful, that the product is very cheap and free from adulteration.

Brown sugar is cane sugar at a certain stage of refinement, and contains some of the impurities which are removed before the finished product is reached. *Molasses* is a product in the course of the manufacture of cane

sugar. It is a residue left after the crystallizable sugar has been removed. It contains some organic acids.

Grape sugar, or glucose, occurs in almost all fruits, with or without some cane sugar. As seen on the market, it is usually manufactured from starch. It crystallizes less readily, and possesses less sweetening power than cane sugar.

Milk sugar, or lactose, is an ingredient found in all kinds of animal milk in varying proportions. It is not so sweet as cane sugar, but it is readily digestible.

Fruit sugar, or levulose, is an ingredient of most fruits, and is supposed to be a form of sugar allowable in diabetes, as it is not known to appear in the urine, while all other sugars, if taken in excess, will appear in the urine.

Honey is a mixture of 35 per cent. grape sugar, 39 per cent. fruit sugar, with water and flavoring materials.

Other forms of sugar occur, but those mentioned are most commonly met with.

Sugars require less digestion than any other alimentary substances which have to be digested before absorption. All sugars are converted into glucose before absorption, but this is a relatively simple process as compared to the series of changes which other foods must undergo.

The food value of sugar is practically identical with that of starch, as all starch must be converted into sugar before absorption for utilization in the body is possible. Sugar is, however, a concentrated form of nourishment, possessing the special property of delaying muscular fatigue and of quickly reviving muscles wearied by hard exercise. This function of sugar has been frequently proven by scientific experiment. By producing force and heat through its combustion, it spares the fat, and some

of it may be converted into fat. Its liberal use should, therefore, be avoided in obesity.

The quantity of sugar, which may be safely taken, cannot be definitely stated, as different individuals show varying power in their ability to utilize it. The proper use of sugar is to avoid too great a quantity at a time, and to take it in proper dilution. The injury that the use of sugar produces to the digestive processes is often due to its concentration. The form in which nature provides sugar, as in milks and fruits, is in weak solution, rarely more than from 4 to 6 per cent., and this fact of nature is suggestive. When sugar is taken in excess in any form, or too concentrated, as in free use of candies and syrups, it is apt to undergo fermentation in the stomach and intestines, producing alcohol and various acids, which may cause inflammation of the lining membranes. The relative readiness with which they undergo these fermentative changes is given by Davis as follows: Lactic acid fermentation—levulose, lactose, cane sugar; butyric acid fermentation—levulose, cane sugar, lactose; alcoholic fermentation—maltose, cane sugar, levulose, lactose. It is thus evident that lactose is less likely to produce fermentative disturbances than any of the other forms of sugar. For this reason, it should be selected for use in modifying cows' milk for children.

VEGETABLES.

Vegetables practically derive their value as foods entirely from carbohydrates and salts, as, with the exception of legumes, they contain so small a percentage of proteid that their contribution of this substance is of little consequence in the total supply to the body, and even that which they provide is difficult of digestion. This is partly

due to the increased activity of the intestines, caused by the greater bulk which vegetables present, and partly to the physical arrangement by which some of the albumin of vegetables is enclosed in cells of cellulose like starch. Vegetable proteid contains less nitrogen than animal proteid; hence, vegetables alone are not an economical food, as the quantity necessary to obtain the requisite nitrogen would be so excessive as to overtax the digestive organs. Vegetables contain a very low percentage of fat.

TABLE XI.—PERCENTAGE COMPOSITION OF DIFFERENT VEGETABLES.

Kind of vegetable.	Proteid.	Fat.	Carbohydrates.
	Per cent.	Per cent.	Per cent.
Asparagus	1.8	0.2	3.3
Beans, butter	4.7	0.3	14.6
" Lima	18.1	1.5	71.1
" navy	22.5	1.8	59.6
" string	2.1	0.3	6.9
" string, canned	1.1	0.1	3.8
Beets	1.3	0.1	7.7
Cabbage	1.4	0.2	4.8
Carrots	0.9	0.2	7.4
Celery	0.9	0.1	2.6
Corn, canned	2.8	1.2	19.0
" green	1.2	0.4	7.7
Cucumbers	0.7	0.2	2.6
Lettuce	1.0	0.2	2.5
Mushrooms	3.5	0.4	6.8
Onions, dry	1.4	0.3	8.9
" green	0.5	0.1	5.5
Parsnips	1.3	0.4	10.8
Peas, canned	3.6	0.2	9.8
" dried	24.6	1.0	62.0
" green	3.6	0.2	9.8
" split.	24.6	1.0	62.0
Potatoes	1.8	0.1	14.7
" Saratoga chips	6.8	39.8	46.7
" sweet	1.4	0.6	21.9
Pumpkins	0.5	0.1	2.6
Radishes	0.9	0.1	4.0
Rhubarb	0.4	0.4	2.2
Roman lettuce	1.0	0.2	2.5
Salsify (as parsnips)	1.3	0.4	10.8
Sauer kraut	1.7	0.5	3.8
Soup greens	1.8	0.4	1.7
Spinach	2.1	0.3	3.2
Squash	0.7	0.2	4.5
Succotash, canned	3.6	1.0	18.6
Tomatoes "	1.2	0.2	4.0
" conserve	0.7	0.1	57.6
" fresh	0.9	0.4	3.9
Turnips	0.9	0.1	5.7
Water-cress	4.2	0.6	6.3

Vegetables eaten in large quantities increase the amount of carbon dioxide eliminated by the lungs, render the urine alkaline, and increase the alkalinity of other secretions. Many vegetables are laxative, some by reason of their chemical composition, others on account of the seed which they contain, and others from the bulk of residue which they leave. Some vegetables, like potatoes, have the opposite effect, as they are so completely absorbed. Many, by virtue of their salts and vegetable acids, are anti-scorbutic.

A classification of vegetables is difficult. An effort to classify from the standpoint of their composition gives a division into "heavy vegetables," which contain a high percentage of starch, and "green vegetables," which are chiefly valuable for their salts. Distinction is sometimes made between vegetables that grow underground and those that grow above the ground. A profitable combination of the two methods seems possible by division into "heavy roots and tubers," "succulent roots and tubers," and "green vegetables."

Heavy Roots and Tubers.—This class forms the source of valuable foods, their value depending chiefly upon the starch which they contain. They are inferior in nutritive value to cereals, as their proportion of proteid is small and they contain a relatively large amount of water.

Irish potato, sometimes called white potato, is composed largely of water, but is a very valuable food on account of the starch which it contains, often in as great a proportion as 20 per cent. It also furnishes valuable salts of potassium, calcium, and sodium. Its content of fat is minute and the nutritive proteid, chiefly in the juice, is less than 1 per cent.

The minute starch granules are surrounded by the potato juice. When heat is applied in cooking, the albumin of this juice is coagulated and at the same time its water is absorbed by the starch granules, which causes them to swell and burst their envelope of cellulose and gives to a properly cooked potato its dry (mealy) appearance.

The manner of cooking a potato has much to do with its nutritive value. If first peeled and soaked for some time in cold water, as is frequently done, a large proportion of its valuable components will be lost by the escape of albumin and salts. Such loss, also, materially affects the flavor. Potatoes should be cooked with their jackets on, by roasting, baking, or steaming preferably, as by these methods very little of the nutritive materials or flavoring substances are lost, though even when boiled the loss is not excessive if the skin has not been removed. When properly cooked, the starch of potato is readily digested. Cooking potatoes in large pieces, so that they are not thoroughly masticated, renders them much less digestible. One or two well-baked potatoes will leave the stomach in two to two and a half hours, and over 90 per cent. of the starch is absorbed from the intestines. New potatoes, while containing a little more proteid than old potatoes, have so much more water proportionately that the starch granules cannot utilize it all, and they cannot therefore be cooked mealy, but on cutting have a "waxy" appearance. Such potatoes should not be given to invalids. This vegetable has little cellulose and on that account tends to be constipating to many persons. It is evident that potatoes alone will not make a proper food for man, and that they should be eaten with meats and fats to balance the diet. They keep well, and have anti-

scorbutic properties by virtue of their salts. They are therefore useful for long sea voyages.

Sweet potato is a tuber very popular in Southern countries. It contains more water than the Irish potato, about 16 per cent. of starch, and 10 per cent. of sugar. It is therefore a nutritious food. It has a palatable, pleasant flavor, but on account of its large percentage of water and lower percentage of starch it does not cook "mealy," which renders it less easily digestible than Irish potato. The sugar, too, makes it unsuitable for many persons. The flavor can be greatly improved by proper cooking. While the sweet potato of ordinary size may be cooked sufficiently to eat in twenty minutes, a much longer time is necessary to develop the flavor. Slow cooking for an hour or longer gives the best results.

Yam is a larger tuber than the sweet potato, which it closely resembles. It differs from the sweet potato in that it contains a greater amount of starch, on account of which it is drier when cooked. It is not sweet like a sweet potato and can therefore be eaten by many persons with whom sweet potato disagrees.

Arrow-root, tapioca, and **sago** are practically pure starch foods. The first two are derived from the tuberous roots of tropical plants, while sago is procured from the pith of the sago palm. They are nutritious, easily digested, non-irritative forms of starch, and are somewhat less liable to undergo fermentation in the stomach and intestines than other starches. They are therefore useful for invalids. They are usually prepared in the form of puddings or are added to soups of various kinds.

Succulent Roots and Tubers.—This class of foods is often spoken of as "fresh vègetables." Their nutritive

value is small, and they are chiefly useful for giving variety in the diet. As they contain considerable amounts of cellulose, they should be thoroughly boiled in order to soften the cellulose before serving or cooking by other methods.

Jerusalem artichoke in composition somewhat resembles the Irish potato, though it contains no starch. Having 14 per cent. of sugar, it is sweet and watery when cooked, but, lacking starch, it cannot be cooked mealy. It is therefore less digestible than potato. Its flavor is delicate and agreeable. Although it contains about 3 per cent. of nitrogenous substance, it has not a high food value.

Carrots have but low food value as they contain only about 8 per cent. of carbohydrates, consisting chiefly of sugar and a very minute amount of proteid and fat. They contain water and a relatively large amount of cellulose, and are, therefore, not readily digestible, remaining in the stomach from three to three and one-half hours. Carrots must be cooked before eating, but suffer much loss in nutritive value by the process, which reduces the sugar one-fourth.

Salsify and **parsnip** resemble carrot in their composition, though they contain more carbohydrates, as much as 10 per cent., which renders them somewhat more nutritious. They are specially valuable for variety, and though they contain much cellulose are fairly digestible when thoroughly cooked. Parsnips are liable to produce flatulence.

Turnip contains over 90 per cent. of water and only about 5 per cent. of carbohydrate, and has, therefore, little food value. It has, however, a pleasant flavor and is valuable as an easily obtained fresh vegetable. It

contains much cellulose, which makes it indigestible for many persons, and it is prone to produce flatulence.

Beet contains 70 per cent. of water and about 8 per cent. of carbohydrates, chiefly sugar. It is one of the common sources of cane sugar for market, and the manufacture of beet sugar is now one of the great industries. As a vegetable it has some nutritive value, and is good when young and tender; the flavor is agreeable, and it gives variety.

Radish closely resembles the turnip in composition. It is of little value as a food, and is chiefly used as a condiment on account of its aromatic, pungent flavor. It is usually eaten raw, and partly on this account and partly because of its pungent properties it is liable to irritate the stomach, producing eructations and flatulence. It should never be allowed to invalids.

Onion contains nearly 9 per cent. of carbohydrates. It is used as a vegetable and as a condiment because of its pleasant flavor, which it owes to a pungent oil. When young and tender it is very digestible, and if cooked with milk becomes a nutritious dish. It is antiscorbutic, and is mildly laxative. It is eaten both raw and cooked.

Green Vegetables.—This class of foods contains no proteid or fat of consequence, and most of these vegetables have less than 4 per cent. of carbohydrates. Their value is derived from the mineral salts and vegetable acids which they contain. They are composed of 80 to 90 per cent. of water, with a large amount of cellulose. They are, therefore, bulky foods and are laxative on account of their undigestible residue. Most of them require thorough cooking by boiling to soften the cellulose in order to render it digestible. If they are old they become stringy and woody from the great increase in their cellulose,

and are then very indigestible. They contain essential oils and ethers which give them agreeable flavors, and it is chiefly for the variety which they thus give to diet that they are of value. They are useful antiscorbutics on account of the potash salts which they contain.

Cabbage, sauer kraut, cauliflower, and **Brussels sprouts** form a group having similar dietetic properties. They contain sulphur and are apt to decompose in the intestines, producing flatulence. They cause calcium oxalate in the urine, and are, therefore, forbidden to persons with gouty diathesis. They contain a large amount of cellulose. Cauliflower and Brussels sprouts have the more delicate flavors. Sauer kraut is cabbage that has been fermented. They are not suitable foods for invalids. They have marked antiscorbutic properties. Though it is usual to cook all of these vegetables before serving, many persons can eat raw cabbage in the form of a slaw without injury, though they are made ill by eating cabbage that has been cooked.

Kale, spinach, turnip-tops (greens), and **dandelions** form a class which are frequently called salads. They have no nutritive value, and contain a large amount of cellulose which renders them entirely indigestible. They are valued for their pleasant flavors and the freshness which they give to a meal. They should be thoroughly cooked in order that they may be more readily masticated, and they are best served finely chopped or in the form of purées. Vinegar is frequently used with them after boiling to further soften the cellulose and increase the flavor. Their bulk of residue renders them laxative.

Celery, lettuce, water-cress, tomato, and **cucumber** constitute a group which are usually eaten raw as salads with

salt, oils, and other dressings. They have no nutritive value.

Celery has much stringy fibre and is, therefore, more digestible when cooked. Stewing in milk makes it palatable and nutritious. It is especially prized as a winter vegetable.

Tomatoes are easily digested, whether raw or cooked. They are acid and very refreshing. On account of their seed they are laxative. They contain oxalic acid, and are, therefore, unsuitable for persons with gouty diathesis.

Lettuce is valuable chiefly as a green winter vegetable. For many persons it has soporific properties. This, with the preceding vegetables, has valuable antiscorbutic properties, and they are not liable to undergo fermentation.

Cucumbers have a pleasant flavor, but are notoriously indigestible. They should be well soaked in ice-water before serving. They are largely used for making pickle, and in this form are prized by persons who can eat such food. They should have no place in an invalid's dietary.

Egg-plant is in composition much like tomato, but it is much less digestible. It has an agreeable flavor, developed by cooking. It is never eaten raw, and should be forbidden to invalids.

Asparagus, when young, is very digestible and it possesses a delicate flavor. Naturally grown the tips are green. The better grades are bleached and are less bitter than the green. It is especially valuable as an early spring vegetable. It is diuretic and imparts a peculiar, unpleasant odor to the urine. It is supposed also to be a cardiac sedative.

Rhubarb, although of stringy fibre, is, when well cooked, very digestible. It has a tart flavor and is laxative; hence, useful in constipation. It produces calcium oxalate in the

urine and should, therefore, be forbidden in gouty and rheumatic diatheses.

Squash, or **cymbling,** contains a little more carbohydrates than most green vegetables, but has little nutritive value. When young and well cooked it is easily digested.

Peas, beans, and **corn,** while having a great nutritive value when dry on account of their high percentage of proteid and carbohydrates, must be classed, when green, with other green vegetables. They contain a little higher percentage of carbohydrates than other green vegetables. They are among the most palatable foods of this class. Though containing a large amount of cellulose, they are very digestible when young and thoroughly cooked. If they are old, the great toughness of their cellulose renders them indigestible and they are apt to produce laxativeness and often will pass through the alimentary tract undigested.

Vegetable marrow has a delicate flavor and is easily digested, but on account of the high percentage of water which it contains possesses no nutritive value.

Alligator Pear.—This fruit is a native of tropical America. The edible portion is in the form of pulp, surrounding a large seed in the centre. It is very soft in texture and is frequently used for salads. The edible portion constitutes 71 per cent. of the whole fruit.

It weighs about three-fourths of a pound. As a food its value is not very great, its chief use being the variety it makes in the diet.

The composition as compared with other fruits is striking, as it contains more than 10 per cent. of fat, in this respect resembling the olive.

Olives.—There are two well-known food products derived from the olive—olive oil and pickled olives. The

fruit is originally from Europe, but of late California has produced it. In appearance it is similar to an oval damson, with color varying from purple to black. The flavor is invariably sour.

The worth of both pickled olives and olive oil is familiar. The oil, which is a valuable fat, is used as a salad dressing and for frying; the pickled fruit as a relish and for seasoning.

Besides being useful as a relish, pickled ripe olives possess considerable food value. The green fruit should be eaten in small quantities as a relish, but ripe olives can be taken in the same proportion as any other similar food. They have been used in some countries of Europe as a staple food.

Mushrooms.—There is a popular belief that this class of foods is extremely nutritious. By some it is thought to rank next to beefsteak in its content of nitrogen. From this idea has arisen the name of "vegetable beefsteak."

From the recent investigations of the Sheffield Institute of Yale University, mushrooms were found to contain as high as 92 per cent. of water—thus ranking as a vegetable. As a nitrogenous food its percentage was very low. In their proteid content, mushrooms rank about the same as potatoes, but are decidedly inferior, as they contain less carbohydrates.

The same investigations at Yale showed further that 26 to 59 per cent. of the dry matter was totally indigestible. Thus its value as a digestible food is less than the potato.

Although mushrooms possess no great value as a nutritive food, they are very useful as food accessories and condiments. When cooked with other foods they form very palatable and attractive dishes. They can be made more useful by careful cultivation and marketing.

FRUITS.

Fruits are essentially carbohydrate foods, as such food value as they possess depends upon their content of sugar and starches. Besides these substances, fruits contain cellulose, a jelly-producing substance called pectose, various salts of organic acids with potassium, and, sometimes, sodium and magnesium. The more important acids found in fruits are citric, malic, and tartaric. Citric predominates in lemons, limes, and oranges; malic in apples, pears, peaches, and apricots; and tartaric in grapes. Fruits contain less earthy salts than any other foods. The differing flavors of fruits are due to essential oils and compound ethers which they contain.

While some fruits are useful as foods, and their salts and acids are beneficial, most of them are used for the variety which they furnish in the diet. Those having the greatest value as nutrients are bananas, dates, figs, prunes, and grapes, all except bananas depending for their value chiefly upon the sugar contained. Bananas, besides sugar, contain a good deal of starch.

Melons, oranges, lemons, and shaddocks are chiefly useful for their pleasant flavor with acids and the water which they contain in high percentage.

Besides supplying nutriment, fruits produce certain effects in the body for which they are especially valuable. Antiscorbutic action, which improves the blood and stimulates secretion, is possessed in great degree by those fruits which are rich in potash salts, as well as lime and magnesia. Among these are apples, limes, and oranges. Some fruits act as diuretics, this effect being due partly to the water contained, but largely to the organic acids

and salts, which improve the circulation and stimulate the renal cells.

The eating of fruit, even of the so-called acid fruits, such as oranges, renders the urine less acid, as the alkalies, which they contain in the form of various organic salts, are excreted by the kidneys in the form of carbonates. They are, therefore, beneficial in gout and similar conditions. Many fruits have happy laxative effects. This is due largely to the great bulk of indigestible material, such as cellulose, seeds, etc., which, by mechanical irritation of the lining membrane of the intestines, stimulate their peristaltic movement, and partly to the chemicals which the fruits contain in solution in their juices. The fruits possessing this property in greatest degree are apples, figs, prunes, and the small berries.

Unripe fruit contains a large amount of cellulose and of starch, and its acids are concentrated. By the ripening of fruit the percentage of cellulose is reduced, it becomes thinner and softer, and therefore more digestible; the starch is largely converted into soluble sugars and the acids are diluted, while the action of these acids upon the sugars develops the grateful flavors. Overripe fruit is that in which changes of decomposition have commenced, and, while the flavor is at first not affected unpleasantly, its ingestion is very apt to cause irritation of the alimentary tract, with griping pains, cramps, diarrhea, cholera morbus, or even fatal gastroenteritis. These effects are due to irritation by the products of fermentation set up by the decomposing fruit.

Unripe fruit may cause similar effects, because of the indigestible quality of the substances of which it is composed, which readily undergo fermentation.

Fruit eaten in moderation, when it is in the proper condition, is wholesome. It may be taken at any time, but the special effects, such as diuresis and laxativeness, will be more pronounced if eaten alone, either sometime before meals, between meals, or at bed-time. The mechanical effects are not then prevented by the presence of other food material, which keeps the lining membrane from close contact with the fruit; nor will the chemicals which they contain be so much diluted. Thus prunes and figs, eaten with dinner, will not have any special laxative effect, but, if taken on an empty stomach at bedtime, or an hour before breakfast, they will have this effect. The worst time for eating fruits is at the end of a heavy, mixed meal. Berries, and fruits with numerous small seed, are not so apt to irritate the stomach and intestines if eaten with bread, because when thus taken the bread encloses them, preventing mechanical irritation.

Fruits are best eaten in season, since those which are transported from a distance are apt to be overripe or decomposing, if they were shipped when ripe; while others, plucked and shipped in the green state, never ripen so thoroughly and effectively as they do naturally, and are, therefore, less digestible. While fruits are valuable in part for their acids, some persons, who suffer from acid fermentation, are made worse by them. It must be borne in mind that many persons have idiosyncrasy for certain fruits, which will invariably produce in them different forms of gastric or intestinal disturbances, hives, and other evidences of poisoning.

Cooking usually renders fruits more digestible, as it softens the cellulose, converts the gum into jelly, and liberates such starch as they may contain. If cooked with

water, however, some of the nutritive ingredients are lost; the softer the structure of the fruit, the greater this loss.

Fruits are often cooked to preserve them. For this purpose cane sugar is added in large amount for its preservative quality. Various preparations are thus made of preserves, jam, marmalades, etc., but, if taken in quantity, they are apt to produce digestive disturbances because of the concentration of the sugar.

Dried fruits cannot be eaten as freely as fresh fruits, because, by the loss of water in the process of drying, they have become more concentrated in the proportion of sugar which they contain. Some dried fruits, such as evaporated peaches, are prepared simply by the removal of the water, while others have cane sugar added as a preservative.

Fruit juices, prepared by simply extracting the juice and boiling to prevent decomposition, or by the addition of strong syrup as a preservative, are useful as flavoring materials, both in health and diseases, if used judiciously.

The average composition of fruits in common use is shown in the following table, taken from Davis's *Dietotherapy* (after Hutchison):

TABLE XII.—COMPOSITION OF FRUITS.

	Water.	Proteid.	Ether extract.	Carbo-hydrates.	Ash.	Cellulose.	Acids.
Apples,	82.5	0.4	0.5	12.5	0.4	2.7	1.0
" dried,	36.2	1.4	3.0	49.1	1.8	4.9	3.6
Pears,	83.9	0.4	0.6	11.5	0.4	3.1	0.1
Apricots,	85.0	1.1	...	12.4	0.5	...	1.0
Peaches,	88.8	0.5	0.2	5.8	0.6	3.4	0.7
Green gages,	80.8	0.4	...	13.4	0.3	4.1	1.0
Plums,	78.4	1.0	...	14.8	0.5	4.3	1.0
Nectarines,	82.9	0.6	...	15.9	0.6		
Cherries,	84.0	0.8	0.8	10.0	0.6	3.8	1.0
Gooseberries,	86.0	0.4	...	8.9	0.5	2.7	1.5
Currants,	85.2	0.4	...	7.9	0.5	4.6	1.4
Strawberries,	89.1	1.0	0.5	6.3	0.7	2.2	1.0
Whortleberries,	76.3	0.7	3.0	5.8	0.4	12.2	1.6
Blackberries,	88.9	0.9	2.1	2.3	0.6	5.2	
Raspberries,	84.4	1.0	...	5.2	0.6	7.4	1.4
Cranberries,	86.5	0.5	0.7	3.9	0.2	6.2	2.2
Mulberries,	84.7	0.3	...	11.4	0.6	0.9	1.8
Grapes,	79.0	1.0	1.0	15.5	0.5	2.5	0.5
Melons,	89.8	0.7	0.3	7.6	0.6	1.0	
Watermelon,	92.9	0.3	0.1	6.5	0.2		
Bananas,	74.0	1.5	0.7	22.9	0.9	0.2	
Oranges,	86.7	0.9	0.6	8.7	0.6	1.5	1.8
Lemons,	89.3	1.0	0.9	8.3	0.5		
Lemon juice,	90.0	...	...	2.0	0.4	...	7.0
Pineapples,	89.3	0.4	0.3	9.7	0.3		
Dates, dried,	20.8	4.4	2.1	65.7	1.5	5.5	
Figs, dried,	20.0	5.5	0.9	62.8	2.3	7.3	1.2
" fresh,	79.1	1.5	...	18.8	0.6		
Prunes, dried,	26.4	2.4	0.8	66.2	1.5	...	2.7
" fresh,	80.2	0.8	...	18.5	0.5		
Currants, dry,	27.9	1.2	3.0	64.0	2.2	1.7	
Raisins,	14.0	2.5	4.7	74.7	4.1		

CONDIMENTS.

Condiments are not nutritious, and are useful chiefly to add flavor to insipid food, to vary monotony, and to stimulate a flagging appetite by their effect on the nerves of taste and by increasing the salivary flow. In some cases of dyspepsia, in which there is fulness and oppression after taking food, condiments, such as mustard or red pepper, taken with the food, will relieve the symptoms by stimulating the local circulation in the stomach. The habitual use of condiments in excess, however, will produce

hyperæmia and catarrh. The effect of condiments in increasing the appetite often causes more food to be taken than can be properly digested in the stomach, which, passing into the intestines, may cause trouble there.

Mustard does not really increase the gastric secretion, but is an irritant to the mucous membrane of the stomach, and by inducing a feeling of warmth produces a sensation which simulates hunger. It is useful in some cases where appetite is lacking without any special gastric derangement, but it is hardly to be prescribed.

Capsicum, or **red pepper**, like mustard, does not increase gastric secretion. It augments the appetite in much the same way that mustard does by stimulating the nerve terminals. It is useful in some cases to counteract the evil effects of certain foods for which there is idiosyncrasy —*e. g.*, strawberries.

Vinegar contains ordinarily from 2 to 7 per cent. of acetic acid. This gives it the property of softening muscle fibre, and it is, therefore, useful if taken with tough meats, such as corned beef. It also aids the digestion of tough cellulose, and is, hence, an ingredient of dressings for salads, such as lettuce and celery, and is added to spinach, turnip-tops, and other green vegetables. It has antiseptic and preservative properties, and is used for these purposes in making pickles. These, however, are always indigestible, and should have no place in a dietary. The various sauces used with meats and in seasoning soups are composed of the different condiments with vinegar, and should be used, if at all, in great moderation. They should be proscribed in all invalid dietaries.

CHAPTER VIII.

FAT FOODS. ANIMAL FATS. VEGETABLE FATS. NUTS.

Fats subserve a similar purpose in the body to carbohydrates in that they are used to produce heat and force. As they contain a smaller proportion of oxygen than carbohydrates, they produce more heat and are a more concentrated food. They contribute to some extent to the formation of tissues.

Fats, by their own combustion, spare waste of the body albuminous tissues, while proteid diet increases this waste. Hence, by the addition of fat, less proteid food will be needed to supply the diminished proteid waste. Some of the fat which escapes combustion is stored in the body, though this reserve supply is derived to some extent from other sources.

Although fats and carbohydrates are used by the body for the same purposes, it is not well, save under exceptional circumstances, to rely solely upon one of these classes of food for a supply of heat and force, for fats alone would not be well tolerated and carbohydrates alone would not spare albuminous waste as fat would. Great variability is shown by individuals in their capacity for digesting fat. Where deficiency in this power exists, proportionate addition must be made of the carbohydrates.

The administration of fats with starches is of practical advantage, since the fat then coats the particles of starch,

preventing agglutination into large masses. Popular knowledge of this fact is shown by the common custom of using butter and gravies with bread and potatoes. An excess of fat is apt to cause indigestion and gastric derangement, since it may then coat the mucous membrane of the stomach and particles of food to such an extent as to prevent free secretion and free contact of the gastric juice with other foods. When taken in excess the fat is liable to collect in large globules and may be decomposed by bacteria present into acids which would irritate the mucous membrane, interfering with normal function.

Fats are digested in the intestine, and, unless decomposition occurs, they pass through the stomach unaltered. Pancreatic juice and bile are both necessary for their proper digestion. Conditions which lead, therefore, to deficiency in either of these fluids would indicate the wisdom of reducing or withholding fats, since in the absence of sufficient secretions to thoroughly digest them, they are liable to undergo decomposition, resulting in irritation with the production of nausea, vomiting, or diarrhea.

Satiety is sooner reached for fats than for any other food, though tolerance may be established by persistent use in small quantities. Animal fats are usually better borne and can be longer eaten than vegetable fats.

The manner of cooking and of serving seems to affect their digestibility. Hot fat is less digestible, as a rule, than cold; especially is this true of the fat of mutton and pork.

Since fats are necessary for growth, nutrition, and heat production, they are indicated in chronic wasting diseases in which there has been much loss of tissue, and in conditions in which nutritive processes are degenerating.

ANIMAL FATS.

Besides the fat of meats, eaten as such, the animal fats in common use are cream and butter, oleomargarine, butterine, bone-marrow, and cod-liver oil.

Beef Fat, etc.—Beef, mutton, and pork fats consist chiefly of the glycerides of the common fatty acids—stearic, oleic, and palmitic. The fat of good beef is wholesome and nutritious, and bacon cooked thin and crisp may be eaten by many invalids, but ham fat and pork fat are very indigestible, especially if eaten hot.

Cream and **butter** are among the most wholesome forms of fat. Cream is a good substitute for cod-liver oil. Few people can take it long in the pure state without gastric derangement, but diluted half with water or Vichy water it is palatable, and usually well borne. Butter is more digestible if spread thin on bread or allowed to soak into hot toast, etc., since this prevents its accumulation in large particles in the stomach.

Oleomargarine is an artificially prepared substitute for butter and is a wholesome form of fat. It is made from beef fat, which is first crushed to mechanically remove the membrane. It is then heated by steam in the presence of water, potassium carbonate, and pepsin (in the form of pigs' or sheep's stomachs) for two hours, after which it is drawn off, cooled, and pressed.

Butterine is a similar product, differing from oleomargarine in the proportion of its ingredients and in the addition during its manufacture of leaf fat from the hog. Both of these preparations are wholesome, but the government now requires that they be labelled, for commercial reasons rather than on account of wholesomeness.

Bone-marrow is a wholesome form of fat, especially the marrow of young animals. Red marrow furnishes a digestible form of fat, together with a digestible form of iron, which is found in it to a considerable extent. This is well administered in the form of glycerin extract, which is easily prepared by rubbing in a mortar the chopped fragments of twelve sheep's ribs with a pound of glycerin. This is allowed to macerate three or four days in a cool place and is then strained through gauze, the resulting liquid being given in teaspoonful doses.

Cod-liver Oil.—This is a readily digested fat. Containing as it does bile salts, it is more readily absorbed than most fats, and on this account has, to some extent, the power of penetrating the skin when rubbed in—a property lacking in most other fats. Advantage is sometimes taken of this in the treatment of marasmic children, in whom inunctions sometimes do good.

This oil has for most persons an unpleasant taste and odor, but by careful administration tolerance can usually be soon established, and children often develop a fondness for it. Its digestibility and agreement will be increased if it is given an hour and a half or two hours after meals, when gastric digestion is well advanced and the chyme is beginning to pass into the intestine. When administered immediately after meals, as is the common custom, the presence of so large an amount of oil will often interfere with gastric digestion, and it may undergo decomposition; while if given at a later period when the food has been largely acted upon, the oil will pass rapidly out of the stomach.

It is better to use a good brand of pure oil than any of the emulsions, as such artificial preparations made with

mucilaginous substances add nothing to its digestibility and unnecessarily increase the bulk for administration. In giving pure oils, it is best to begin with a small dose—say, a teaspoonful—and gradually increase the amount as the patient becomes accustomed to it. If the aversion to it is great, the taste may be covered by administering with malt extract, whiskey, brandy, or strong coffee, or it may be given in flexible capsules. Even a pinch of salt taken before and after the oil will often be sufficient to render it palatable.

VEGETABLE FATS.

These are derived from seeds. The principal members of this group are olive oil, cotton-seed oil, cacao butter, and peanut oil.

Olive oil is made by crushing the whole fruit with the stones and pressing the resulting pulp in bags. This is the best oil, but a second quality is obtained by adding boiling water to the remaining pulp and pressing again. This second oil is much more apt to become rancid. Olive oil is a very pure form of fat and is usually well borne. It may often be substituted with advantage for cod-liver oil.

Cotton-seed oil is often substituted for olive oil, and, indeed, much of the so-called olive oil on the market is made from cotton-seed. It differs in taste and odor from olive oil, and, unless very pure, leaves an unpleasant after-taste, but it is not injurious.

Cacao butter is obtained from cacao seeds in the manufacture of chocolate. Its chief use is for inunctions and suppositories, but it is also used in the manufacture of some infant foods.

Peanut Oil.—The shelled nut contains from 30 to 50 per cent. of oil, which is of fairly good flavor, but inferior to olive oil. As with olive oil, several grades are made. The first cold pressure yields 16 to 18 per cent. of fine table oil. Other grades are made by the addition of water and heating, but are hardly suitable for table use. This oil is not as yet extensively used, but is sold mixed with olive oil for table purposes.

NUTS.

Though nuts have always been used as delicacies and for desserts, but little study has been made of their digestibility. As a class, they have always been considered indigestible. The usual custom of eating them as a dessert, when sufficient food has already been taken, or of munching between meals when the stomach should be resting will largely explain their indigestibility. Their large content of oil, further, may interfere with the digestion of other foods, and when eaten raw, as is done in most instances, their cellulose and starch will be difficult to manage.

Several modern systems of diet include nuts as an important constituent. From the accompanying table it will be evident that they form a concentrated and nutritious food. They are not suitable for food by themselves, as the percentage of fat would be excessive and they should be used with a good proportion of proteid food. On account of the low proportion of carbohydrates, nuts are a suitable food for diabetic patients.

The chestnut differs materially from other nuts in that it contains quite a small proportion of fat and a large percentage of carbohydrates. In some countries, as France and Italy, the chestnut is largely used for food

by the poor. They are there prepared by steaming after shelling, or ground into flour from which sweet cakes are made. Besides the popular roast chestnuts of the street vender, they are used in this country in the form of soups, purées, stuffing for fowls, gravies, and various confections such as marron ice-cream, and the well-known candy, "marron glacé."

Peanuts, which are really a legume, but are used as nuts and so classified by the popular mind, differ from others in their high percentage of proteid. They are popular roasted. Their use has been described.

Nuts are used for various kinds of confections, sandwiches, and other dainty dishes. The accompanying table contains a list of the varieties of nuts commonly used in this country:

TABLE XIII.—COMPOSITION OF NUTS.

	Refuse.	Edible portion.	Composition and fuel value of the edible portion.					
			Water.	Proteid.	Fat.	Carbo-hydrates.	Ash.	Fuel value per pound.
	%	%	%	%	%	%	%	Calories.
Almonds	64.8	35.2	4.8	21.0	54.9	17.3	2.0	3030
Brazil nuts	49.6	50.4	5.3	17.0	66.8	7.0	3.9	3329
Filberts	52.1	47.9	3.7	15.6	65.3	13.0	2.4	3432
Hickory nuts	62.2	37.8	3.7	15.4	67.4	11.4	2.1	3495
Pecans	53.2	46.8	3.0	11.0	71.2	13.3	1.5	3633
English walnuts	58.0	42.0	2.8	16.7	64.4	14.8	1.3	3305
Chestnuts, fresh	16.0	84.0	45.0	6.2	5.4	42.1	1.3	1125
" dried	24.0	76.0	5.9	10.7	7.0	74.2	2.2	1875
Acorns	35.6	64.4	4.1	8.1	37.4	48.0	2.4	2718
Beechnuts	40.8	59.2	4.0	21.9	57.4	13.2	3.5	3263
Butternuts	86.4	13.6	4.5	27.9	61.2	3.4	3.0	3371
Walnuts	74.1	25.9	2.5	27.6	56.3	11.7	1.9	3105
Cocoanut	48.8	51.2	14.1	5.7	50.6	27.9	1.7	2986
" shredded	...	100.0	3.5	6.3	57.3	31.6	1.3	3125
Pistachio, kernels	...	100.0	4.2	22.6	54.5	15.6	3.1	3010
Pine nut or piñon (*Pinus edulis*)	40.6	59.4	3.4	14.6	61.9	17.3	2.8	3364
Peanuts, raw	24.5	75.5	9.2	25.8	38.6	24.4	2.0	2560
" roasted	32.6	67.4	1.6	30.5	49.2	16.2	2.5	3177
Litchi nuts	41.6	58.4	17.9	2.9	0.2	77.5	1.5	1453

CHAPTER IX.

WATER. NON-ALCOHOLIC BEVERAGES. ALCOHOLIC BEVERAGES.

WATER.

Water is a food, as it enters into the structural composition of all the body tissues, forming about 60 per cent. of the body weight. Its regular supply is of more importance to the body than a regular supply of other foods, since men can go for many days without food, but very few days without water will produce disastrous results or even death. When water is withheld, the secretions of the body diminish, and all of the surfaces which are usually moist become dry; kidney activity decreases, and finally the tissues lose their water with the result of failure of muscle power. This interference with the proper elimination of waste products leads to mental affections, delirium, and finally coma and death.

Excessive use of water is also injurious, and the evil effects are frequently observed in warm weather. By excessive drinking the gastric juice is so diluted that it cannot properly digest the foods; furthermore, an excess of water in the stomach is apt to wash the food into the intestine in masses before it has been properly digested. These two causes lead to fermentation and putrefaction of food, with the development of loss of appetite, nausea, vomiting, gaseous distention, and diarrhea. A more frequent error, however, in regard to water is to take too little. The amount actually needed by man

varies between considerable limits. All the water which enters the body leaves the body as water, unchanged. This loss occurs through the kidneys, bowels, skin, and lungs. The condition which increases the rate of loss will demand a corresponding increase in the supply. Thus in hot weather, or while working, circumstances under which sweating is profuse, a greater supply is needed. All solid foods contain a large amount of water. When, therefore, dry foods are largely eaten, more water must be taken as a beverage than with the same amount of succulent foods. The size of the individual will also affect the amount of water needed; a small woman or child will not require as much as a large man.

Water is usually administered by the mouth as a drink. When so taken, a small amount may be absorbed by the mucous membrane of the mouth or stomach, but the greater bulk of it is absorbed from the intestine. It is often a matter of importance to know that water may be satisfactorily introduced into the body by other avenues. For instance, when protracted vomiting prevents the administration of water by mouth, it may be introduced by rectal injection, and is then absorbed by the mucous membrane of the large intestine. When it must be administered in this manner, it is best to use a rectal tube, as the higher the injection is made the less liable will be its expulsion. Water thus administered must always be warm. Another method of introducing water is called hypodermoclysis, or the introduction of water into the loose tissues beneath the skin. When this method is used, a saline solution of normal strength—that is, six-tenths of 1 per cent.—is used, and this must be carefully sterilized before injection.

The elimination of water is performed by the skin, lungs, kidneys, and bowels. The skin and kidney activities are complementary. When the skin is very active, as in warm weather or in a hot, dry atmosphere, the kidney activity diminishes, and *vice versa.* So, too, if the stools are liquid, both skin and kidney functions are diminished. It is evident, therefore, that the actual elimination of water by each of these avenues varies according to conditions, but the approximate elimination is about 28 per cent. through the skin, 20 per cent. through the lungs, 50 per cent. through the kidneys, and 2 per cent. through the feces.

The temperature of drinking-water will vary its effects. Ice-cold water checks the flow of saliva in the mouth and stimulates a more rapid flow of gastric juice. This checking of salivary flow explains why ice-water does not relieve thirst as much as water which is not so cold. The administration of ice-water just before or during a meal will aid the digestion of albuminous food by increasing the gastric juice, but it checks the flow of saliva and the insalivation of starches in the stomach. Hot water, when taken before a meal, will soothe an irritated membrane and help to remove mucus, bacteria, and food remnants from the previous meal, but it will lessen the secretion of the gastric juice. It is beneficial in cases in which the acid of the gastric juice is excessive. Many habits in regard to eating have been followed for ages, and the reason for them only demonstrated in recent times. Thus, ice-cream is eaten at dinner, which is largely an albuminous meal, as it stimulates the gastric secretion which is needed for the digestion of this kind of food, but it is taken at the end of the meal in order that time

may be allowed for the gastric insalivation of the starch food eaten.

The **time** for drinking water is to be considered. For several reasons water should be taken sparingly with meals. If too abundant, the dilution produced in the gastric juice will retard the digestion of albuminous food and permit fermentation and putrefaction. Furthermore, particles of the food may be washed from the mouth into the stomach before they have been masticated, thus rendering digestion difficult. It should be taken, therefore, with meals only when the mouth is empty, and then in small quantities at a time. A small amount of water, thus taken, will help digestion by softening and disintegrating the food. The best time to drink water is about three or four hours after the preceding meal. It then helps to wash the food from the stomach into the intestine and prevents retention in the stomach with decomposition. It is a good practice to drink water on rising in the morning and also at bed-time. This sometimes will relieve mild grades of constipation.

It is quite frequently said that water is fattening. This is not literally true, but the free use of water, by aiding secretion, helps digestion, increases absorption, and distributes food uniformly throughout the body. Alteration in the amount and quantity of food will, therefore, be more rational than a reduction of water for persons who fear an increase of flesh.

The **purity** of drinking-water is of great importance, and the possibility of the transfer of disease-producing agents of animal and vegetable origin by water makes its purity an object for careful investigation, and its source a matter of material import. Drinking-water is usually derived

from springs or rivers and contains various chemicals and gases, which give it palatability and freshness. The purity of water thus derived depends largely upon the amount of its salts. Water containing 5 or 10 grains of mineral salts to the gallon is considered pure, but when 60 or 70 grains are present it may be actively injurious. Waters are termed "soft" or "hard" according to the amount of these mineral salts which they contain.

Rain water is a soft water and more nearly identical with distilled water than any other form, but it contains many soluble gases brought down from the air, and if caught, as is the usual method, from roofs, it will contain dust and bacteria. Hence, if rain water is to be used for drinking purposes, it should be collected only at the end of the shower, after the injurious materials of the air have been washed out. The less salts water contains the better solvent it becomes. Rain water, therefore, should not be kept in leaden cisterns.

Spring water, which has run through gravel, is one of the best sources of supply. In many regions, especially in mountains, it contains an excess of earthy carbonates which may derange digestion and tend to the formation of "stones" in different parts of the body. This is so-called "hard water." This injurious excess of salts may be largely removed by boiling, which liberates the carbonic acid that aids in holding the salts in solution. Precipitation of the salts follows, leaving pure water above, which can then be decanted.

Wells are springs with artificial outlets, but the danger of contamination from neighboring sources through surface drainage must be borne in mind, and the well so located as to avoid this threatening danger. Artesian wells, by

their great depth and their mechanical arrangement, are free from these dangers.

River water that has run over a rock or gravel bed is good if protected from pollution. Oxidation renders much organic matter inert, and rivers are thereby purified of this source of contamination, but not necessarily of disease germs.

Methods of Purification.—Water may be purified artificially in three ways—by distillation, boiling, and filtering. *Distillation* removes both organic and inorganic impurities, so that distilled water is absolutely pure, but it is flat and tasteless. This is due to its lack of air, which may be corrected by shaking in air or pouring back and forth from vessel to vessel. Distilled water is now largely used by ships at sea, which are provided with proper condensing apparatus for this purpose. Small stills for family use are now on the market and may be used with as little trouble as filters. *Boiling* renders water pure except for mineral constituents, and it may lessen these by driving off carbonic acid and permitting precipitation. It destroys disease germs, frees it from all organic impurities, renders all ferments inactive, and drives off all the gases of decomposition which it may contain. *Filtering* clears water and removes its coloring matter, and the best filters, when new, will even rid it of micro-organisms. After a time, however, the filtering material becomes permeated with bacteria, which then may be washed through in great numbers. Much care should be taken to clean filters frequently, and the filtering material should be boiled at least once a week, in order to destroy any germs that it may contain.

NON-ALCOHOLIC BEVERAGES.

Tea.—Many varieties of tea are on the market. The difference in their flavor depends upon the species of plant, the climate and soil in which they are grown, and the time of gathering. Teas are classified as green or black. The difference between them is due to the manner in which they are prepared. Black tea is made by drying the leaves in the sun. They are then mashed and rolled and subjected to fermentation, by which the essential oils are modified and flavor developed. After rolling they are again dried in the sun and finally fired in an oven. Green teas are made of younger leaves than the black and are first dried in pans at a temperature of 160° F. In Japan they are steamed. Rolling, drying in the sun, and sweating in bags then follow, and finally they are slowly roasted.

The nutritive ingredients of tea are so little that they may be disregarded. Its effects are produced by theine, an alkaloid practically identical with caffeine, the active principle of coffee, and theobromine, the active principle of cocoa. The other active ingredient of tea is tannin. The only difference in effects between green and black tea is that green tea contains more than twice as much tannin as the black. This tannin is a vegetable astringent, entirely lacking in nutritive value. In strong solution, or taken in quantity, it precipitates the ferment of the gastric juice, destroying its efficiency. By its astringent effect on the mucous membrane of the intestines it may cause constipation. In general it may be stated that teas contain from 2 to 14 per cent. of theine and from 10 to 25 per cent. of tannin. In the manufacture of green tea the amount of

water and the theine are lessened, while the tannic acid is much increased as compared with the black teas.

In preparing tea the manner of its brewing is of great importance, as the beneficial stimulating properties of the beverage are due to the theine, while the tannin produces injurious effects. Brewing should, therefore, be so conducted that a maximum of theine with a minimum of tannin may be dissolved. The theine is readily and promptly dissolved when boiling water is poured on the leaves, but the tannic acid is much more slowly extracted. About one-third more of tannin is dissolved from the leaves by standing for thirty minutes than if they stand for only five, while the amount of theine will differ but slightly in the two infusions.

To make tea properly, boiling water should be poured over the leaves and allowed to stand from three to five minutes in a warm place, but should not be permitted to boil. If tea is boiled or allowed to stand longer than five minutes, its stimulating effect is not increased, but it becomes stronger in tannin and darker in color. Another good manner of making tea is to let it stand for several hours in cold water. A method used in England is to drop the tea gently on hot water and pour off the brew as soon as the leaves have all uncurled and settled to the bottom of the pot. The water used in tea making should be fresh boiled and not too hard. If stale boiled water is used its air will be driven out completely and the tea rendered less palatable. Long infusion will drive off the aromatic principles and thus injure the flavor of the tea, besides increasing the extractives, which may give an unpleasant flavor to the beverage and render the tea bitter and dark in color. This dark-colored tea is usually con-

sidered stronger, but this is a mistake, as it contains no more stimulating products than a lighter colored tea properly made. On account of the increased amount of tannin contained it does, however, taste stronger, as it is more bitter and astringent to the mouth.

Tea is mildly stimulating to the nervous system, which makes it refreshing, and it relieves fatigue, especially when taken on an empty stomach. Partly by the theine contained, and partly by its heat, tea, to some extent, stimulates circulation. It is also diuretic, and, when taken hot, diaphoretic. Taken cold in warm weather, it is one of the most refreshing beverages. Its very excellence in this way, however, may lead to its excessive use. Tea precipitates the pepsin of the gastric juice, if taken in quantity, and, even if taken more moderately, retards digestion. By overstimulation of the nerves it induces insomnia, nervous tremors, and a tendency to worry. In some instances, by interference with digestion through the precipitation of digestive ferments, it may cause diarrhea. It is more apt to cause digestive disturbances when a person is under great mental strain. It should be avoided if it tends to constipation, nervousness, insomnia, dyspepsia, or gastric irritability. It will often relieve a headache, and is a useful antidote in alcoholic intoxication. The abuse of tea often leads to troublesome palpitation of the heart. Tea inhibits salivary secretion, and is best, therefore, taken at the end of a meal rather than during the meal. Teas are frequently flavored by the addition of leaves of fragrant flowers, such as roses, jessamine, etc.

Coffee.—Coffee is made from the seed of the coffee plant (*Coffea arabica*). These must be roasted in order to produce the characteristic aroma which is due to the develop-

ment of volatile oils. As these flavoring materials are volatile, they will be lost by long keeping. Coffee should, therefore, be freshly roasted before making, if the best aroma is desired. Coffee contains tannin and caffeine, a substance identical chemically and physiologically with theine, the active principle of tea. In the raw state it contains a small amount of sugar, but this is lost in roasting by conversion into caramel. The stimulant effect of coffee is due to the caffeine and the volatile oils. The tannin is, of course, astringent, but constipation is not produced by coffee as it is by tea, on account of the counteracting effect of the volatile oils which it contains.

The effect and excellence of coffee will depend largely upon the method of making. Filtration, by which boiling water is allowed to percolate through finely ground coffee, makes a coffee of good taste, but it is not an economical method, as not nearly so much of the coffee is dissolved as by other methods. It may be prepared by infusion, ground coffee being put in boiling water and allowed to stand ten minutes in a temperature a little under boiling. A decoction may be made by mixing powdered coffee with cold water and bringing it to a boil. When made by this method it is drunk without straining. Continued boiling robs the coffee of its aroma by driving off the volatile oils, and extracts more tannin, rendering it less digestible.

Coffee is often adulterated, usually by the addition of chicory, a root which is roasted and ground for this purpose. It is harmless, and many persons like the flavor that it imparts. Various other substances—such as peas, beans, and acorns—are used for adulterating coffee. These may usually be detected by dropping the coffee into water,

when the coffee, unless overroasted, floats, while the adulterants sink.

Coffee stimulates the functional activity of muscles, removing the sense of fatigue. Although of little nutritive value in itself, it relieves hunger to some extent, and when taken with cream and sugar it makes a valuable food. It is a heart stimulant, and is useful in collapse. It is also a diuretic and a diaphoretic. It stimulates the nervous system, including the nerve centres, thus often relieving headache. It increases mental energy. It excites the flow of gastric juice and, unlike tea, is laxative, being a stimulant to peristalsis, by reason of the empyreumatic oils developed in roasting. Furthermore, the tannin of coffee is in a less active form than that of tea. Its stimulating effects on the nerves and kidneys are greater, if taken on an empty stomach.

Though coffee does not inhibit the salivary digestion as tea does, it materially retards stomach digestion. The practice, therefore, of drinking strong black coffee after dinner should be avoided by invalids, although it relieves an uncomfortable sense of fulness after a heavy meal. Its use as a stimulant for mental work is apt to develop the coffee habit, with its injurious physical results, and the practice of drinking coffee for night work should be vehemently condemned, as its continued use will produce languor, restlessness and insomnia, irritability, dread of ill, dyspepsia, heart-burn, etc. Too frequently daily use leads to the same evil condition. Deprivation will then produce craving.

The relative value of tea and coffee depends entirely upon individual peculiarity, some persons being able to drink tea freely who are made nervous and sleepless by a

little coffee, and *vice versa.* The addition of cream and sugar to coffee renders it frequently indigestible to persons who can take it straight with impunity. A small cup of black coffee, taken early in the morning before breakfast, will often relieve constipation.

Cocoa and Chocolate.—Cocoa is prepared from the seed of the *Theobroma cacao.* These are either dried immediately in the sun or are previously kept in a warm, moist place and allowed to ferment in order to improve the aroma, which, as with coffee berries, is further developed by roasting. Cocoa contains 45 to 50 per cent. of fat (known as cocoa butter), about 15 per cent. of albuminous substances, and about 15 per cent. of starch. Besides these nutrients it contains a small amount of volatile oil developed in roasting and about 1½ per cent. of theobromine, an alkaloid chemically identical with caffeine, but differing from it in that it does not cause sleeplessness or muscular tremors, nor does it stimulate the mind to such an extent, although it relieves the sensation of muscular fatigue. It is obvious that the chief nutritive value of cocoa is due to the fat which it contains. The large proportion of this often renders it indigestible, and many preparations on the market are made by adding other substances with a view of lessening the percentage of fat. The preparations containing sugar are quite nutritious, though the sugar added may interfere with digestion. Unlike coffee and tea, excessive use of cocoa does not disturb the nervous system. Cocoa is a useful beverage for children, if a good preparation is selected, but it leaves a large residue of undigested waste, and is, therefore, not so easily digestible as is generally believed.

"Cocoa nibs" are the finely ground kernels, from which

a decoction is made by boiling in water and then straining before using. Cocoa is usually prepared for the market, however, by mixing the ground kernels with sugar or starch into a paste. If made with sugar it may be prepared simply by the addition of hot water, but if made with starch it must be boiled. The fat and albumin, upon which the nutrient value of cocoa depends, are not soluble. The preparations of so-called "soluble cocoa," from which these ingredients have been removed, are therefore without nutritive value. The fat is removed in the manufacture of many preparations of cocoa for invalids' use, and while these are lacking in nutritive value, they form a pleasant beverage and are better borne by feeble stomachs. Some preparations are made by the addition of an alkali for the purpose of rendering them more digestible by saponifying the fat. These are good in some cases, but may neutralize the acidity of the gastric juice.

Chocolate is a preparation of cocoa, to which sugar, starch, and flavoring substances, usually vanilla, have been added. It contains 50 per cent. or more of sugar. As a beverage made with milk, it is very nutritious and, when pure, is digestible, unless sugar disagrees. Chocolate is a useful vehicle for disguising the unpleasant taste of meat extracts and medicines. These preparations of cocoa are relatively as promptly digested as tea and coffee, leaving the stomach in about two hours if made with water, and in two and one-half hours if made with milk.

Cola.—Cola, made from the cola nut, derived from tropical countries, resembles both coffee and chocolate and is used similarly. It contains caffeine and theobromine, a little fat, sugar, starch, albumin, tannin, and a milk-digesting ferment. It is believed to lessen tissue

waste, is a mild stimulant to the heart and nervous system, a diuretic and somewhat tonic to the stomach. It increases muscular endurance, and is a temporary substitute for food. It is prepared like coffee, by infusion, only not so strong, and, served with milk and sugar, it is not unpleasant to the taste and is well borne by delicate stomachs. Its continued use in quantity will cause insomnia and produce nervousness.

Coca, a very different substance from cocoa, is derived from the leaves of the *Erythroxylon coca* and possesses stimulating properties, due to its active principle, cocaine. It lessens the sense of hunger, and is sustaining in great muscular exertion; it is also a mental stimulant, but its use is dangerous, as it may lead to the formation of the cocaine habit, which is easily acquired. Various beverages are offered at soda-water fountains which contain either coca or cola. While they are refreshing and, perhaps, not harmful as an occasional drink, their constant use leads to grave derangement of the nervous system, and even to the formation of a "habit."

ALCOHOLIC BEVERAGES.

Ethyl alcohol is the active principle of these beverages, and is contained by them in amounts varying from 3 to 50 per cent. or more. This variation in the percentage of the alcohol contained explains the difference in the effects produced by the use of these beverages, as their taste and appearance are due to the kinds of grains and fruits from which they are manufactured, and the resulting variations in the amount of sugar and volatile substances which they hold.

As the dominant effects of all of this class of beverages are due to the alcohol which they contain, a consideration of the effects of alcohol seems first in order. There is, perhaps, no substance used in medicine about which there is greater dispute. Certain effects are definitely observable, but the manner in which they are produced is not yet finally settled.

Alcohol, when brought into contact with animal tissues, robs them of some of their water, deprivation of which causes precipitation of the albumin of the cell. If this is not redissolved, the cell soon loses its function. Thus alcohol acts as a protoplasmic poison.

When taken into the mouth, alcohol produces a sense of warmth, caused by arterial congestion, and if in strong solution it causes some puckering by its astringent effect and a deposit of coagulated albumin on the surface. Similar effects occur in the stomach. Taken diluted before meals, alcohol causes an increase in the flow of saliva and gastric juice, which increases appetite. This is produced by reflex action from irritation of the nerve terminals of the mucous membranes. If taken with meals, digestion is retarded by coagulation of albumin and precipitation of pepsin from the gastric juice, the flow of which is checked by large amounts. In the intestine the retarding of digestive processes is even greater, a much smaller amount of alcohol lessening the secretion of the pancreas, while in astringent effects its action is similar to that in the stomach.

If no more than an ounce and one-half of alcohol is taken in a day, it is burned in the body and does not appear in the excretions as alcohol, but if a larger amount is taken it will be eliminated as alcohol by the kidneys and lungs.

When absorbed into the blood, it lessens the oxygen of the red corpuscles, and is itself partly oxidized. Under the influence of alcohol the red blood corpuscles contain oxyhæmoglobin, a substance which does not readily give up its oxygen. Combustion is, therefore, lessened; hence the fats and carbohydrates are not burned as normally, but are deposited in the tissues as fat, producing obesity. Another effect of the lessened combustion is diminution of heat production; hence a lowering of temperature. Alcohol further lowers body temperature by producing dilatation of the superficial capillaries, thereby increasing radiation from the body and evaporation, thus further robbing the body of its heat, although a sensation of warmth is produced by the increased amount of warm blood brought in contact with the sensory nerves.

The combustion of alcohol in the body, of course, produces some heat, but it does not increase force. This has been definitely shown by experiments, which proved that, while a man under the influence of alcohol feels strong, he is incapable of doing as much work as under normal conditions. The combustion of the alcohol increases the carbon dioxide given off, but does not affect the nitrogenous waste. The question of its value as a food is a much disputed point, advocates of both views deriving their conclusions from its course in the body. It is unnecessary to give the various arguments here. Suffice it to say that, if a food, it is one which has no advantage over many other food substances, and is, therefore, never necessary for food purposes.

Moderate amounts of alcohol cause the heart to beat faster and more forcibly. As this effect is observable before the alcohol can be absorbed, it is evidently due,

largely, if not entirely, to reflex action by irritation of the nerve terminals of the mouth and stomach. Alcohol produces relaxation of the muscle walls of the arterioles, with consequent dilatation. As a result of this the blood rapidly enters the veins from the arteries, and, because there is less blood in the arteries, the pulse seems bounding. This condition further explains the apparent stimulation of the heart, which appears to act more forcibly because the resistance, normally met with, is removed by the lessening of blood in the arteries. These effects tend to equalize the circulation in conditions characterized by congestion of the viscera and mucous membranes.

Habitual use of alcohol will produce paralysis of the vessels, with permanent distention. Such a condition is familiar in the reddened noses of habitual drunkards. The apparent stimulation of the heart by alcohol is not well maintained, and is soon followed by evident depression.

The effects of alcohol on the nervous system are interesting. Under its influence the vessels of the brain are dilated like those elsewhere in the body. The result of this increased blood supply, together with the direct effects of the drug on the brain cells, produce a similarly increased mental activity; thoughts and imaginations come in rapid turn, and speech is more ready. There is a loss of self-consciousness, which makes the person under this influence feel more at ease. Such cerebral excitement is invariably followed by depression, and, if the use of the drug is continued, the familiar reaction of mind and body witnessed in drunkards supervenes.

The most modern investigations as to the effects of alcohol seem to show that it is at no time a stimulant, but from the beginning a depressant in its effects. The

explanation of the apparent stimulation of heart and brain action is that the drug affects the higher centres first, and as its administration is continued it gradually reaches the lower centres; thus, by depressing the inhibitory cells of the brain, restraint is removed and control lessened, this being the first effect. As a result the heart acts more rapidly and more vigorously. Thoughts and images come more promptly and speech flows more readily, because of the release of control, which normally restrains for the sake of judgment. Impulse is controlled by the action of the higher inhibitory centres; and by the progressive depression of these centres judgment diminishes as the alcohol is increased. The ease and self-possession felt under alcoholic influence are due to just the same release from restraint which to many persons is a normal condition, and by them called self-respect. That alcohol affects the nerve centres in descending order is shown by observation of the development of drunkenness, in which the patient first becomes garrulous, then excited and emotional or pugnacious, then staggers, finally loses power of speech and grows insensible to pain inflicted.

The habitual use of alcohol leads to degenerative changes of tissues and the development of fibrous or fatty substances in place of the normal cells. Metabolism becomes more and more deranged, with the development of gout and other similar troubles. Kidney disease and liver disease are frequently induced by the habitual use of alcohol.

As with other drugs, the susceptibility of individuals to alcohol is very variable, some being able to take, without evident effect, amounts which in others will produce intoxication. Attention must be called to another indi-

vidual peculiarity in regard to the use of alcohol, that some persons are unable to use the drug in moderation and invariably take it excessively, if they use it at all. This idiosyncrasy is often due to heredity. While some persons can use alcohol moderately without evidence of harm, its use in health is never necessary, while in diseases the effects which it produces can be as well or better obtained from other drugs, and it is now avoided in many diseases in which, a few years ago, it was considered an essential part of treatment.

Alcoholic beverages are classified as distilled and fermented, the former including spirits and liquors, the latter wines and beers. By fermentation of various saccharine substances, alcohol may be developed. This action is due to the effect of yeast on sugar, which breaks it up into alcohol and carbonic acid. After fermentation is completed, the mixture consists of sugar, ferments, water, and alcohol. The alcohol may be separated from this mixture by distillation. The odor and flavor of the different kinds of spirits are produced by volatile ethers and oils developed during fermentation, and vary according to the different substances which have been subjected to the process of fermentation. Any substances which contain sugar or starch may be used for the fermentation of alcohol. Those most commonly used for the manufacture of spirits are barley, rye, corn, rice, potato, sugar, and molasses. The spirits most commonly used in this country are whiskey, brandy, gin, and rum. These vary in alcoholic strength from 15 to 58 per cent. Proof spirit contains 49 parts of alcohol and 51 of water, and has a specific gravity of 0.92. Spirit containing more than this amount of alcohol is called overproof, while that con-

taining less than proof spirit is termed underproof. The spirits distilled from grain or potato are liable to contamination by the presence of other alcohols than ethyl alcohol. Amylic alcohol, commonly known as fusel oil, is a common impurity of spirits. Redistillation will separate the pure alcohol, which is more volatile than fusel oil, the latter being left behind in the still.

Whiskey.—Whiskey is made by the distillation of fermented rye or corn, or a mixture of these two with wheat. It should be at least two years old before using. Its strength is from 50 to 58 per cent. by volume, and its specific gravity from about 0.93 to 0.917. As spirits increase in age, the volatile ethers that give flavor to them change in character, and the flavor becomes more agreeable. The Scotch and Irish whiskies are made, usually, from barley. The smoky flavor so characteristic is due to the peat and turf fires used in drying the grain.

Brandy.—Brandy, when pure, is distilled usually from fermented grape juice or wine, although other fruits than grapes are used for special kinds of brandy. The quality depends upon the kind of wine from which it is made, the finest being made from white wines. The color of fine brandy is developed from the oak casks in which it is kept, from which some tannin is extracted. Inferior grades of brandy are colored with caramel. Cheap grades are manufactured from potato, rice, and corn. These contain much more fusel oil and other toxic alcohols than that distilled from wine. Apple brandy is distilled from cider.

Brandies vary in strength from 42 to 55 per cent., and the specific gravity from 0.941 to 0.925. Brandy should be kept for several years to ripen. This improves the flavor, though the alcoholic strength diminishes. Cherry

brandy, distilled from ripe cherries, is used to some extent in America and largely in Europe.

Gin.—Gin, sometimes called Hollands, is doubly distilled from rye or corn. By redistillation it contains less solid matter than other spirits. The flavor is acquired by the addition of juniper to the mash during distillation. It contains 15 or 20 per cent. of alcohol, but is frequently strengthened by the addition of proof-spirits, until it contains 30 to 35 per cent. Sugar is added to some brands, so that gin may be obtained either "sweet" or "dry."

Rum is distilled from fermented molasses, when properly manufactured. Many brands on the market, however, are made by flavoring rectified spirits with molasses, caramel, or other flavoring substances. Its alcoholic strength is equal to that of brandy and whiskey.

These spirits are identical in their alcoholic effects, the differences observed in their use being due to the special aromatics and volatile ethers and oils which they contain. Gin interferes less with digestion than either brandy or whiskey, and is an excellent diuretic, stimulating the kidney cells. Brandy interferes with digestion more than whiskey, partly because of the different aromatic substances and partly by reason of the tannin which it contains. The presence of this tannin renders brandy more astringent than whiskey. It is, therefore, often preferred in diarrhea, when it is of great value, if pure.

Liqueurs and **bitters** are made from pure alcohol, or various spirits or wines, by the addition of sugar and aromatics. Curacoa is flavored with orange peel; Noyeau with peach and apricot kernels; Maraschino with cherries; Kümmel with cumin and carraway seed; Anisette with

aniseed and coriander. Chartreuse and Benedictine are distilled from a mixture of aromatic substances. Absinthe is flavored with fennel, which gives it a bitter taste.

Wines.—By the term "wine" is usually understood a beverage made by the fermentation of grape juice. Many other substances which contain sugar are fermented into wines, however, such as various berries—gooseberry, blackberry, elderberry, etc. The properties of wines, beyond the alcoholic effect common to all, depend upon the kind of grapes used, circumstances of soil, climate, and season, together with the degree of ripeness at the time the grapes are pressed. The flavor of wine, like the flavor of spirits, is due to volatile ethers developed by the action of the acid, which wines contain, upon the alcohol. Recently, variation in flavor has been found to vary with the kind of bacteria present, and isolation of certain species of yeast enables the winemaker to produce desired flavors by their introduction into the "must," as the expressed juice is called.

Different amounts of alcohol are developed, according to the degree to which the sugar is broken up by fermentation, and this depends upon the amount of albuminous material which the grape contains, because the yeast feeds upon the albumin and, during its growth, ferments the sugar. In grapes which contain much albumin this process continues until a large proportion or all of the sugar is broken up, while, if little albumin is present, the process is checked before a large amount of the sugar is changed. Therefore, grapes containing little albumin will produce a sweet wine, while those rich in albumin will produce a "sour" or "dry" wine.

Naturally wine contains not more than 15 to 16 per

cent. of alcohol, as greater strength than this kills the yeast cells. Wines which contain a higher percentage than this have been "fortified" by the addition of alcohol. This is done in order to aid the flavor and to prevent further fermentation. Sherries and most champagnes are fortified wines.

The grape pulp furnishes sugar, organic acids and their salts. From the seed are derived the essential ethers which give aroma, while the skins and stems supply coloring matter and tannin. The tannin is preservative and prevents mouldiness. Wines are varied in flavor artificially by the addition of extraneous substances.

White wines are made from selected white grapes and crushed with their skins, or from colored grapes from which the skins have been removed. When white grapes are used the juice is left in contact with the skins for several days, in order to abstract their soluble materials, and is then expressed, after which fermentation is obtained by exposure to the air, in which yeast germs are always present.

Red wines are made from colored grapes, the skins, stones, and stems being left to ferment with the pulp. These are, therefore, more nutritious than white wines, and more astringent on account of the tannin extracted from the skins and stems.

When fermentation is completed, white of egg or other similar substance is added to clear the wine. This acts just as when it is used for clearing coffee; the albumin, being coagulated by the alcohol, carries down with it impurities, leaving the wine bright and clear. Most wines contain some free tartaric acid and small amounts of malic and acetic acids. White wines contain most acid.

The chief constituents of wines are alcohol, sugar, tannin, free acid, and ethers, and, according to the predominance of these ingredients, they are classified as spirituous wines, red or astringent wines, white or acid wines, and sparkling wines.

Spirituous wines are those which have been fortified and contain more than 15 per cent. of alcohol. They are subdivided into "dry" or "sweet" wines according to the extent to which the sugar has been fermented. Examples of "dry" spirituous wines are port, sherry, old Madeira, etc. These contain 17 to 22 per cent. of alcohol. "Sweet" spirituous wines, such as Tokay, Malaga, Malmsey and sweet champagne contain about the same amount of alcohol, but more sugar.

The best kinds of *red wines,* which are slightly astringent from the tannin contained, are the French clarets or Bordeaux wines and the Burgandies, though good clarets are made in America. These wines are usually wholesome, especially if taken diluted with plain or aërated water. Burgandies contain more alcohol than the Bordeaux wines.

White wines are more acid than the red wines, but contain much less tannin. They are somewhat diuretic and are wholesome, especially when diluted with alkaline mineral waters, which counteract their excessive acidity. Examples of white wines are Rhine wines, Moselle, Barsac, Chablis, and some of the sauternes, though some of the latter are strongly saccharine.

Sparkling wines are those in which carbon dioxide is produced by bottling before fermentation is complete, gas being developed in the bottle by continuance of the fermentation. This is called "natural sparkling." Artificial sparkling is produced by introducing carbon dioxide

into the wine, as is done at soda-water fountains. The better the wine, the longer will the liberation of carbon dioxide continue after the cork is drawn. These are possibly the best for invalids, being palatable and having a pleasant odor. They are sedative in nausea and vomiting, and are quickly absorbed. The type of sparkling wines is champagne, which is made by a special process and kept in bottles until fermentation of the sugar is more or less complete. Champagnes, which contain a good deal of sugar, are termed "sweet." Those in which fermentation has been carried farther, so that they contain very little sugar, are termed "dry" or "sec," while those in which the fermentation is complete are termed "brut." The proper fermentation of champagne requires a number of years, and some manufacturers have substituted an acid fermentation which is completed in much less time, but this can be detected by litmus paper after the carbon dioxide has passed off.

All wines check the chemical process of digestion, and to a degree far greater than their alcohol would explain. This is probably due to the effects of the acids and ethers which they contain. Salivary, gastric, and pancreatic digestion are all retarded. Sherry and port are most effective in this regard, clarets are less so, and champagne least of all. While wines retard the chemical process of digestion, they stimulate the motor functions, when taken in small quantities.

Persons leading active lives, with much physical effort, can take more wine without harm than those of sedentary habits. Mixing different kinds of alcoholic drinks at a time is notoriously a more injurious practice than the taking of an equal amount of alcohol of a single kind.

Habitual use of wines is apt to derange digestion, producing sour stomach and even serious gastritis. Persons suffering from lithæmia, gout, or rheumatism are invariably made worse by the habitual use of wines, and often even by occasional indulgence. As to which wines will best suit such patients, when they are desired or necessary, is a question chiefly of experience with the individual, as wines which one person can take without apparent injury will often bring on a violent attack in another. Ill effects in these patients are usually delayed, sometimes as long as forty-eight hours.

CHAPTER X.

QUANTITY OF FOOD. FREQUENCY OF FEEDING. RELATION OF FOOD TO EXERCISE, SLEEP, AND TOBACCO. FOOD IN CHILDHOOD AND OLD AGE.

From what has been stated in the earlier chapters, it is evident that a mixed diet is the best for health. After the natural growth has been attained, the purpose of food is to replace the body waste and to supply heat and energy for its activities. For the former purpose proteid is essential, and this is provided in most readily digestible form in animal foods; while for the latter purpose reliance is placed chiefly upon carbohydrates supplied by vegetable foods and fats, of which the animal fats are more readily digested. It has been shown that the most vigorous exercise does not increase proteid waste; hence excess of this class of food will add nothing to the individual's activity.

Proteid is given in training for efforts producing physical strain, in order that the muscles may be large and sound so that they will respond quickly to nervous impulses; but fats and carbohydrates must be abundantly given in order to supply an added source for increased activity. It is evident, therefore, that the proportions of the different classes of foods must be varied to meet different conditions. Thus a boat crew training for a race, in which a sudden spurt of muscular effort is to be made, will be given proportionately larger amounts of proteid; while day

laborers, whose muscular effort is continued, are supplied with proportionately larger amounts of fats and carbohydrates.

It would be desirable to maintain an equilibrium between the intake and output of the body—that is, to supply proteids in just sufficient quantity to repair the actual waste of the cells—and to give fats and carbohydrates in the exact amount required to restore heat as it is lost and provide energy for the necessary body functions. This ideal arrangement is practically impossible to maintain, as conditions which affect the need of the body for food vary so constantly that no fixed rules can be given which would meet this need. Habitually, therefore, we consume more than enough to maintain the equilibrium in order to escape the graver condition of taking too little, which would lead to inanition. In estimating the quantity of food required, it must be remembered that only averages can be stated and that quantities must be increased or diminished according to conditions present.

Quantity.—The two chief factors in estimating the quantity of food necessary are body weight and exercise or work. It has been estimated that the individual at rest consumes from 30 to 35 calories per kilo of body weight in a day, or a little more than 18 calories per pound, and that one doing light work uses about 40 calories per kilo. A man of average size at moderate work will require about 3000 calories per day. This will be represented in from 40 to 60 ounces of ordinary solid food, which is equivalent to about 23 ounces of water-free food. The relative proportion of nitrogenous to non-nitrogenous substances should be about as 1 to 3½ or 4. Estimates of different investigators vary somewhat as to the proportion

of fats to carbohydrates as a source of carbon. The standard daily diet of Moleschott gives proteid 20 per cent., fat 13 per cent., carbohydrates 62 per cent., salts 5 per cent., or, in actual amounts, proteid 130 grams (4.59 oz. av.), fats 84 grams (2.96 oz. av.), carbohydrates 404 grams (14.26 oz. av.), salts 30 grams (1.06 oz. av.), total water-free food 648 grams (22.87 oz. av.); while Pettenkofer and Voit give proteid 137 grams, fats 117 grams, carbohydrates 352 grams, salts 30 grams, total water-free food 636 grams.

Calculated by the fuel values given on page 26, the former provides 2883.6 calories, while the latter provides 2997.3 calories. Cornet states as the average requirement, proteid 120 grams, fats 50 grams, and carbohydrates 500 grams, which give a total of 2925 calories. It is evident from these estimates that approximately the same fuel value may be supplied with considerable variation in the amounts of the different constituents of diet.

In constructing a diet it must be remembered that we can only approximate accuracy, since there are several factors in every computation which introduce errors—*e. g.*, variation in digestive power of individuals for special articles and kinds of foods.

The table on page 28 gives the percentage composition of certain foods and their fuel value, but the body does not derive this amount of nutriment from them, since they are not wholly digested. From the results of a large number of experiments the proportion of different foods which is digested has been determined, and this is called the percentage of digestibility or the coefficient of digestibility. The available energy or nutritive value derivable from foods will depend on the completeness of oxidation

of the nutrients in the body, and this differs somewhat from the fuel values as given in Table I. The following table gives the coefficients of digestibility and the available fuel value.

TABLE XIV.—COEFFICIENTS OF DIGESTIBILITY AND FUEL VALUE PER POUND OF NUTRIENTS IN DIFFERENT GROUPS OF FOOD MATERIALS.

Kind of food.	Proteid.		Fat.		Carbohydrates.	
	Digestibility.	Fuel val. per pound.	Digestibility.	Fuel val. per pound.	Digestibility.	Fuel val. per pound.
	%	Calories.	%	Calories.	%	Calories.
Meats and fish	97	1940	95	4040	98	1730
Eggs	97	1980	95	4090	98	1730
Dairy products	97	1940	95	3990	98	1730
Animal foods (of mixed diet)	97	1940	95	4050	98	1730
Cereals	85	1750	90	3800	98	1860
Legumes (dried)	78	1570	90	3800	97	1840
Sugars	...	......	...	......	98	1750
Starches	...	......	...	......	98	1860
Vegetables	83	1410	90	3800	95	1800
Fruits	85	1520	90	3800	90	1630
Vegetable foods (of mixed diet)	84	1840	90	3800	97	1820
Total food (of mixed diet)	92	1820	95	4050	97	1820

In estimating the food value of a diet, therefore, the percentage of any nutrient as given in Table I. must be multiplied by the coefficient of digestibility, in order to determine the amount of such nutrient available for the body's use in any special article. Thus in Table I. it is seen that beef ribs contain 13.9 per cent. of proteid, but from Table XIV. it is seen that the digestible amount of proteid derived from meats is only 97 per cent. of that contained in the meat; hence the proteid in meat available by the body is only 13.5 per cent. of the weight of the meat consumed.

In the following table the nutrients and energy of the digestible portion of many common foods is given.

TABLE XV.—NUTRIENTS AND ENERGY OF DIGESTIBLE PORTION OF SOME COMMON FOODS, WITH NUTRITIVE RATIOS.

Kind of food materials.	Refuse.	Water.	Total indigestible nutrients.	Digestible nutrients. Proteid.	Fat.	Carbo-hydrates.	Ash.	Fuel value per pound.	Nutritive ratio.
ANIMAL FOOD.	%	%	%	%	%	%	%	Calories.	1 :
Beef, fresh:									
Chuck, ribs	16.3	52.6	1.4	15.0	14.3	...	0.6	910	2.1
Loin, medium	13.3	52.5	1.6	15.6	16.6	...	0.7	1025	2.4
Ribs	20.8	43.8	1.8	13.5	20.0	...	0.5	1135	3.3
Round, medium	7.2	60.7	1.4	18.4	12.2	...	0.8	890	1.5
Shoulder and clod	16.4	56.8	1.2	15.9	9.3	...	0.7	715	1.3
Beef, dried and smoked	4.7	53.7	4.5	25.6	6.6	...	5.5	790	0.6
Veal:									
Cutlets, round	3.4	68.3	1.2	19.5	7.1	...	0.8	695	0.8
Leg	14.2	60.1	1.1	15.0	7.5	...	0.7	625	1.1
Mutton:									
Leg	18.4	51.2	1.4	14.6	14.0	...	0.6	890	2.2
Loin	16.0	42.0	2.0	13.1	26.9	...	0.5	1415	4.6
Pork, fresh:									
Loin, chops	19.7	41.8	1.8	13.0	23.0	...	0.6	1245	4.0
Ham	10.7	48.0	1.9	13.1	24.6	...	0.6	1320	4.2
Pork, salted and smoked:									
Bacon	7.7	17.4	4.4	8.8	59.1	...	3.1	2720	15.1
Ham	13.6	34.8	3.1	13.8	31.7	...	3.2	1635	5.2
Salt, fat	...	7.9	5.4	1.8	81.9	...	2.9	3555	
Poultry:									
Fowl	25.9	47.1	1.2	13.3	11.7	...	0.5	765	2.0
Turkey	22.7	42.4	1.6	15.6	17.5	...	0.6	1060	2.5
Fish, fresh:									
Cod, dressed	29.9	58.5	0.5	10.8	0.2	...	0.6	220	0.1
Mackerel	44.7	40.4	0.7	9.9	4.0	...	0.5	370	0.9
Shellfish:									
Oysters, solids	...	88.3	0.6	5.8	1.2	3.3	0.8	225	1.0
Fish, preserved and canned:									
Cod, salt	24.9	40.2	5.1	15.5	0.4	...	13.9	325	0.1
Salmon, canned	...	63.5	1.9	21.1	11.5	...	2.0	915	1.2
Eggs, uncooked	11.2	65.5	1.1	12.7	8.8	...	0.7	635	1.7
Dairy products:									
Whole milk	...	87.0	0.5	3.2	3.8	5.0	0.5	310	4.3
Skim milk	...	90.5	0.3	3.3	0.3	5.1	0.5	165	1.8
Cream	...	74.0	1.1	2.4	17.6	4.5	0.4	865	18.4
Butter	...	11.0	4.9	1.0	80.8	...	2.3	3410	
VEGETABLE FOOD.									
Cereals, etc.:									
Cornmeal	...	12.5	3.3	7.8	1.7	73.9	0.8	1640	10.0
Oat breakfast food	...	7.8	5.1	14.2	6.6	64.9	1.4	1800	5.6
Rye flour	...	12.9	2.9	5.8	0.8	77.1	0.5	1620	13.6
Rice	...	12.3	2.9	6.8	0.3	77.4	0.3	1625	11.5
Wheat flour, patent process	...	12.0	3.4	9.7	0.9	73.6	0.4	1635	7.8
Wheat breakfast food	...	9.6	3.8	10.3	1.6	73.7	1.0	1680	7.5
Bread, etc.:									
Bread, white wheat	...	35.3	2.9	7.8	1.2	52.0	0.8	1200	7.0
Crackers, cream	...	6.8	4.5	8.2	10.9	68.3	1.3	1925	11.3

TABLE XV. (Continued).

Kind of food materials.	Refuse.	Water.	Total indigestible nutrients.	Digestible nutrients. Proteid.	Fat.	Carbo-hydrates.	Ash.	Fuel value per pound.	Nutritive ratio.
VEGETABLE FOOD.	%	%	%	%	%	%	%	Calories.	1 :
Vegetables:									
Beans, white, dried	...	12.6	7.9	17.5	1.6	57.8	2.6	1520	3.5
Beets, fresh	20	70.0	0.8	1.1	0.1	7.3	0.7	160	6.8
Cabbage . .	15	77.7	0.6	1.2	0.2	4.6	0.7	115	4.2
Potatoes .	20	62.6	1.2	1.5	0.1	14.0	0.6	295	9.5
Squash . . .	50	44.2	0.4	0.6	0.2	4.3	0.3	100	7.8
Sweet potatoes, fresh	20	55.2	1.6	1.2	0.5	20.8	0.7	440	18.3
Tomatoes:	...	94.3	0.5	0.7	0.4	3.7	0.4	95	6.6
Fruits:									
Apples . . .	25	63.3	1.2	0.3	0.3	9.7	0.2	190	34.7
Bananas .	35	48.9	1.6	0.7	0.4	12.9	0.5	260	19.7
Grapes	25	58.0	1.7	0.9	1.1	13.0	0.3	295	17.2
Oranges . .	27	63.4	1.0	0.5	0.1	7.7	0.3	150	15.8
Strawberries .	5	85.9	1.0	0.8	0.5	6.3	0.5	150	9.3

In the last column, "nutritive ratio," is given the ratio of digestible proteid to the digestible fats and carbohydrates, as contained in the different articles listed. In calculating this ratio 1 part of fat is taken as equivalent to $2\frac{1}{4}$ parts of carbohydrates, as this is approximately the ratio of their fuel values. (See p. 26.) Since it was seen above that for wholesome diet the ratio of nitrogenous to non-nitrogenous foods should be as 1 to $3\frac{1}{2}$ or 4, a glance will show the unsuitableness of most articles of food as the sole diet.

From the above and previous considerations it is evident that proper diet for a healthy adult should consist of a mixture of the different kinds of food in correct amount and proportions. Variations from the above statements of the quantity needed must be made according to conditions, such as physical development, sex, climate, occupation, age, and other personal peculiarities.

A man of large frame, with heavy bones and well-developed muscles, will naturally require more proteids to keep his tissues in healthy condition than a small, poorly developed person. Similarly, more force is necessary for his activity and he loses heat more rapidly, since his body surface is greater. Hence, more carbohydrates and fats will be required.

Sex influences the quantity of food necessary, women, as a rule, requiring less than men. This is due partly to the difference in habits and partly to structural differences, as it has been found in prisons, where men and women were doing the same work, that women require about one-fifth less food than men.

Climate modifies the required quantity. Cold weather stimulates respiration and circulation and induces active exercise, all of which results in increased metabolism and a greater demand for food. Body heat is lost more rapidly in cold climates, and this requires a greater supply of heat-producing food. Hot weather, on the other hand, produces languor and lack of appetite, and less exercise is usually taken, so that a reduction in the food allowance should be made.

Occupation has an important influence on the quantity of food. Physical labor and active exercise promote oxidation by increasing respiration and circulation. Greater waste results, therefore, which must be supplied by an increase of food. Since such work requires abundant muscular tissue of good quality, proportionately more proteid must be included in the diet than for those who lead less active lives. It is customary in prisons to give the persons at hard labor one-fifth more food than those doing moderate work.

Persons doing mental work require less food than those performing hard physical work. As the digestive functions are less active and the metabolic processes slower, their food should be lighter and more readily digestible. Foods rich in nitrogen, such as heavy meats, should be taken in moderation, the lighter meats, such as fowl and fish, being preferable for them. Milk, eggs, good bread, fresh vegetables and fruits should constitute the major part of their diet. Fats, since they constitute a considerable proportion of brain substance, should be freely given. The best forms in which to use them are butter and cream, breakfast bacon and olive oil.

Overeating.—Only a certain amount of food can be digested and absorbed in a given time. Therefore, if more food is eaten than can be digested, some of it will pass into the intestine unaltered, which is liable to produce irritation. On the other hand, if too much is absorbed, the blood is loaded and the excretory organs overtaxed. Consequently, overeating at single meals or for a short period may cause dyspepsia, gastroenteritis, diarrhea, etc., while continued and habitual overeating will cause congestion of the liver, with engorgement of the stomach and intestines, resulting in furred tongue, headache, and "biliousness," and ultimately in gout, lithiasis, or arteriosclerosis, especially if the consumption of proteids be excessive.

Age produces a marked difference in the requirements for food. The growing child and youth on the one hand and old age on the other need foods of such different quality and amount from what is required by the healthy adult, that diet for these will be considered under special sections. The requirements of different individuals as

to quantity under varying circumstances, compared with a man at moderately active muscular work, is approximately as follows:

Man at hard muscular work requires 1.2 the food of a man at moderately active muscular work.

Man with light muscular work and boy fifteen to sixteen years old require 0.9 the food of a man at moderately active muscular work.

Man at sedentary occupation, woman at moderately active work, boy thirteen to fourteen, and girl fifteen to sixteen years old require 0.8 the food of a man at moderately active muscular work.

Woman at light work, boy twelve, and girl thirteen to fourteen years old require 0.7 the food of a man at moderately active muscular work.

Boy ten to eleven and girl ten to twelve years old require 0.6 the food of a man at moderately active muscular work.

Child six to nine years old requires 0.5 the food of a man at moderately active muscular work.

Child two to five years old requires 0.4 the food of a man at moderately active muscular work.

Child under two years old requires 0.3 the food of a man at moderately active muscular work.

Frequency of Feeding.—The usual custom in America is to take three meals a day. From time to time advocates arise for the plan of two meals or one meal a day. If the daily allowance is to be the same, there is no apparent reason why two meals are more wholesome than three. If the purpose of the reduction in the number of meals is to lessen the amount of food taken, it would be more rational to diminish the quantity at each of the three meals a day, since it is an established fact that the stomach

performs its functions better when small amounts of food are taken frequently than when a large amount is taken at once.

Assuming a three-meal system, the consideration of the best hours for meals resolves itself practically into the question of the advantages of a midday or an evening dinner, which occupation, climate, and personal habit will decide. As a rule, men doing muscular work, such as laborers, do better on a midday dinner, since their early hour for rising necessitates that they go to bed soon after the evening meal; but for professional men and those of sedentary pursuits the evening dinner is usually preferable, since a heavy meal in the middle of the day is apt to make them drowsy and dull. On the other hand, vigorous mental work checks digestion much as strong emotion will; so that the heavy meal should be taken at a time when mental rest will follow, if indigestion is to be avoided. For business men the evening dinner has the advantage of being at an hour when more time can be devoted to it, and thus temptation to bolt their food in order to return to business is removed. When dinner is taken in the evening, it should be so timed that gastric digestion will be well established before bed-time. Three hours at least should intervene between the dinner and the time of retiring.

Recently many advantages have been claimed for abstinence from breakfast, the advocates of this plan taking nothing until the noon lunch. This may be a good practice for some individuals, but it is not rational for the average man to do without some food very soon after rising. A long fast has already occurred since the preceding meal, and to further extend it, while doing active work,

is liable to cause exhaustion and be injurious. The fasting body in the early part of the day is especially apt to be harmed by exposure to cold and infections. If the heavy meal has to be taken at noon, it is well for the breakfast to be a light one.

When an early and light luncheon is taken and the evening dinner is late, the English custom of afternoon tea about five o'clock is a good one, since it tides a person over a period of the day when fatigue is apt to become evident. Such a tea should be very light, nothing more solid than a few crackers being taken with a cup or two of hot tea.

Exercise and Digestion.—Violent exercise taken immediately after eating will retard digestion and may even produce dyspepsia or vomiting. This is due to the fact that exercise diverts blood from the digestive organs, causing it to pass to the periphery. A further factor which may have some influence in delaying digestion is the accumulation in the blood of waste products produced by exercise, which lessens the activity of the digestive organs by interfering with their control through depression of the nerves. On the other hand, moderate exercise aids digestion and absorption by its stimulating influence on the circulation and respiration. Mild exercise before breakfast is beneficial to some persons, but vigorous exercise should not then be indulged in unless a very heavy meal has been taken the night before. Great fatigue retards digestion, and after violent exercise a brief period of rest should be taken before eating.

Sleep and Digestion.—During deep sleep the circulation and respiration are slower, secretion is lessened, and digestion consequently delayed. For this reason it is

unwise to retire after a heavy meal at night, before the stomach digestion is at least well under way. Furthermore, the sleep is apt to be disturbed. The processes of digestion cause an increased circulation of the abdominal organs with corresponding changes in cerebral circulation, and, in addition to this, the products of digestion, absorbed into the blood, may stimulate the higher nervous centres, with the result that sleep is disturbed by dreams. On the other hand, hunger produces restlessness and wakefulness. Going to bed late without dinner or supper will often cause insomnia. In such cases it is well to give a cracker and glass of milk or beer just before retiring, and this is usually sufficient to relieve the symptom.

Tobacco and Digestion.—The moderate use of tobacco stimulates the salivary and intestinal secretions and increases peristalsis in the stomach and bowel, though it probably lessens the free hydrochloric acid of the gastric juice. A smoke after eating is, therefore, beneficial to many persons, but smoking before meals is always injurious. The habitual use of tobacco in quantity will disturb digestion and cause dyspepsia through its depressant effect on the nervous system. When food cannot be obtained after violent exercise, tobacco lessens the sensation of hunger by depressing the nerves. The habit of chewing is more harmful to digestion than smoking.

Food in Childhood.—The conditions of infant life are so different from those met with in other periods that the subject of infant feeding is treated of in a separate chapter. The consideration of this section is with regard to the period of school life, from six or eight years of age to, say, eighteen years. This is the period of active growth of body and mind, and one of the frequent errors made by

parents is in pushing the mental development at the expense of the physical. The irrationality of such a course, which leads too often to ill health and consequent interference with mental development, will be appreciated if one considers the provision of nature which permits an increase of mental growth throughout life, or at least until the degeneration of age begins, while physical growth is completed at the age of twenty-one to twenty-five years.

The period of school life is one of great activity and it is essential, therefore, to supply abundantly materials for the body's need. Proteids must be liberally given, since they are required not only to replace the waste as in adults, but also to provide material for the production of new tissues. Fats and starches must be generously supplied for the development of heat and energy, the former also because they are important factors in tissue growth. Sugars are necessary for the production of energy. The craving of young persons for sweets is a natural demand, but in supplying it the caution previously given as to the concentration of sugars must be borne in mind. The rate of digestion in children is often very rapid, and simple, wholesome food, such as bread and butter, should be accessible to them when they are hungry. On the other hand, when children lack appetite, they must be encouraged to eat.

Meals should be attractively served with regularity and punctuality. The custom in many schools of "keeping in" through the dinner hour is an injurious one, since children often are unable to eat a proper meal because of exhaustion when the meal has been too long delayed by this practice. Sacrifice of the usual Saturday holiday would be a more rational method of discipline.

Dinner for children should be at noon or early in the

afternoon, since their earlier bed-time would make an evening dinner too heavy. The smaller children should have something to eat about eleven or twelve o'clock, if their dinner is as late as one or two, but if dinner is taken at twelve a bite should be given them in the afternoon three to four hours later. Good breads, meats, fish, farinaceous foods, fresh vegetables and fruits should form the bulk of the diet. Sugar with chocolate or cocoa as beverages and in the form of pure candy, and simple puddings, creams, jellies, and preserved fruits should be given. As to the quantity it must be remembered that a child of ten requires about half as much food as a man, while a boy of fifteen years needs as much as a man. Meat should be given twice a day, preferably at breakfast and dinner. At Rugby vigorous boys are allowed nine and one-half ounces of cooked meat daily. Special care should be taken to see that school-girls are supplied abundantly with easily digested meats, since chlorosis is frequently developed at the age of puberty from lack of proteids and salts of iron which meats supply.

As in all other dietaries, variety is essential to health. Green vegetables are too often omitted from children's diet. They are of special advantage during school life, when comparatively little exercise is taken and long hours in the school-room are necessary, since they act as natural laxatives and prevent the development of constipation, which often begins at this period of life, to be a continued source of discomfort or ill health in after years.

Diet for the Aged.—It is a popular fallacy that the quantity of food should be increased with age. In old age the natural degeneration of the body structures lessens the activity of the secreting organs, the circulation is less

vigorous, and the nervous system less active. The muscles of the intestine with the other muscles of the body lose their tone, so that peristalsis is diminished. Digestion and absorption are consequently slower. Less food is, therefore, required to replace the slower waste in old persons. The total quantity should, consequently, be reduced; otherwise waste will accumulate and many of the disorders due to deficient elimination are liable to develop, such as gout and rheumatism. Caution must be observed in reducing the food, which should be done gradually. As the quantity is lessened, the frequency should be increased so that small amounts are given at comparatively short intervals. Meats, particularly, should be limited. If teeth are absent, tough foods should be avoided, and meats should be finely minced or pounded into a paste, but a strictly liquid diet should not be resorted to until absolutely necessary, as mastication aids digestion by increasing the flow of saliva. Tender fowl and other meats, white fish, eggs, nutritious soups, and milk will supply the necessary proteid. Bread and farinaceous foods, potatoes, and fresh vegetables should be freely used. The latter are best given in the form of purées. Ripe, fresh fruits and stewed or baked fruits are useful. For beverages tea and coffee are good stimulants, but in the majority of persons alcohol is injurious. Cocoa and chocolate may be given and water should be taken freely, as it aids in eliminating the waste products.

Approximate Quantities.—A practical notion of quantities may be obtained from the following approximations taken at random, which any housekeeper may extend at will by a little experimenting:

A roll 3 inches long, 2¾ inches wide, and 1½ thick (about

$12\frac{3}{8}$ cubic inches) weighs $1\frac{9}{10}$ ounces. A slice of bread 1 inch thick, 3 inches wide, and $3\frac{1}{2}$ inches long (about $10\frac{1}{2}$ cubic inches) weighs one ounce. It is evident that the difference in the quality of the flour and the texture of the bread will affect the weight.

A piece of cooked steak 4 inches long, 3 inches wide, and 1 inch thick (12 cubic inches) weighs 9 ounces; or 1 cubic inch of steak weighs $\frac{3}{4}$ of an ounce; or 1 ounce of steak would be a piece $\frac{1}{2}$ inch thick, 1 inch wide, and not quite 3 inches long. The weight of steak will vary according to the kind of steak and the fatness of the meat.

A medium-size Irish potato boiled after peeling weighs 6 or 7 ounces.

A baked sweet potato 4 inches long and 2 inches thick with tapering ends weighs 3 or 4 ounces.

Four lumps of sugar weigh 1 ounce. An even tablespoonful of granulated sugar weighs $\frac{1}{2}$ ounce.

A heaping tablespoonful of boiled turnip-tops weighs 1 ounce.

A heaping tablespoonful of boiled rice weighs 1 ounce to $1\frac{1}{2}$ ounces.

A medium-size hard-boiled egg weighs about $1\frac{1}{2}$ ounces.

A medium-size apple (raw) weighs 2 to 3 ounces.

The following approximations are often used for measuring liquids: 1 ounce is equivalent to 8 teaspoonfuls, or 4 dessertspoonfuls, or 2 tablespoonfuls. A sherry-wine glass is equivalent to 1 ounce, a claret-wine glass to 3 ounces, a teacup to 6 ounces, a tumbler to 8 ounces.

CHAPTER XI.

FOOD IN INFANCY.

It is a proper or improper nutriment which makes or mars the perfection of the coming generations. The largest part of the immense mortality during the first year of life is traceable directly to disorders of nutrition. The question whether a child shall be strong and robust, or a weakling, is often decided by its food during the first three months. An infant spends most of its time sleeping and growing, and at this time the muscular effort is not great. It therefore follows that the diet of an infant should contain relatively more of the tissue builders (proteids and mineral matters) and relatively less of the energy producers (carbohydrates) than one finds in the food of the adult. We know that human beings in the first twelve months of life are carnivora, and it is evident that animal food, entirely and freshly derived from animal and not vegetable sources, has been proved to be the nutriment on which the greatest number of human beings live and the least number die. In the case of infants no better illustration can be given than the frequency of scurvy, rickets, marasmus, indigestion, and diarrhea, owing to the too exclusive use of carbohydrates, such as most proprietary foods. Many things are valuable as temporary foods which, when used permanently, are injurious.

The infant, like other small animals, has a large extent of surface in proportion to its bulk, and therefore requires an abundant supply of body fuel. This is supplied by fat.

In infancy and childhood, as in adult life, the elements of food are five in number—proteids, carbohydrates, fat, mineral salts, and water. The form in which they must be furnished and the relative quantities in which they are demanded are different from those required by the adult. If the tissue-builders are not sufficiently represented, the muscles, blood, and bones are not properly formed, and the child becomes flabby, pale, and rickety.

In infancy proteids are first in importance, since they constitute the only kind of food which is capable of replacing the continuous nitrogenous waste of the cells of the body. Without the aid of carbohydrates or fats, proteids can sustain life for a time, but in such a case an excess of proteids is needed. Such a diet would severely tax the digestive organs and kidneys.

Proteids are furnished by the casein and other albuminoids present in both woman's and cows' milk, in the white of egg, gluten of wheat, fibre of muscle, etc. It is the great difficulty in the digestibility of proteids that causes the principal troubles in the substitution of cows' milk for woman's milk. In woman's milk the proteids represent about 1.5 per cent. of the total quantity. While cows' milk contains 3.5 per cent. proteids, the casein forms five-sixths of the total proteids, or 2.9 per cent. In woman's milk the casein forms two-sixths of the proteids, or 0.3 per cent. The casein of cows' milk is therefore nine times as abundant as the casein of woman's milk. The casein of cows' milk belongs to the nucleoalbumins.

The carbohydrates are one of the most important sources of animal heat. Carbohydrates are not, as we have seen, of so much importance in the dietary of infancy as in that of older children or the adult. They are important aids to

the proteids, and in this respect are more valuable than fats. Carbohydrates are the most abundant of the solid elements of the foods; they form, however, a smaller percentage of the entire quantity of food in infancy than in adults. A diet of carbohydrates often leads to an increase in weight, but not accompanied by a proportionate increase in strength. An infant, which is the victim of such an error, may be plump enough, but the muscles soft and flabby, its skin pale, and its bones rickety. Disorder will easily result from the fermentation due to excess of carbohydrates.

The fats, as has been observed, are the greatest source of animal heat, and the use of fats in the body are intimately associated with those of proteids. The fats are very important in saving nitrogenous waste. When fat is supplied in the food in the proper quantity, the entire energy of the proteids can be expended upon the growth and nutrition of the cells of the body. The demands made upon the proteids by the rapid growth of the body in infancy make it desirable that whenever possible the fats should aid the work of the proteids. The fats, in addition to their use as a source of animal heat, add to the body weight by storing up fat in the body.

Fats are essential to the proper growth of nerve cells and fibres and especially bone. Fats also fill the role of a natural laxative, constipation being the first and most striking symptom following the reduction of fat in the milk. The proportion of fat required in infancy is very much greater than at any other period of life. One of the principal sources of error in artificial feeding is the deficiency of fat. An excess of carbohydrates cannot supply a deficiency in fat.

The importance of fats in nutrition does not end with the first year, but a liberal supply should be used throughout childhood in the form of eggs, butter, cream, and cod-liver oil. Cod-liver oil is of much greater value for children than for adults. The mineral salts necessary in infancy and childhood are furnished in abundance in both woman's milk and cows' milk.

The value of water is realized when one recollects that nearly three-fourths of the whole body consists of water, and that water constitutes 87 per cent. of milk. Frequently a drink of water will stop a child from crying when all other resources have proved useless. During the summer the value of water is rarely sufficiently realized. The cry of the modern medical man, during the summer, is more water and less food.

During the first year of life the superiority of woman's milk over cows' milk is so generally acknowledged that it has become an axiom. Woman's milk is surely an ideal infant food, and no artificial food has been found that can be compared with woman's milk, nor has the milk of any other animal been found that can fully supply its place. In Japan, where women have a remarkable abundance of milk and give their children no other food during the first year, rachitis is never seen. In the race for life, the artificially fed infant stands a poor chance as compared with the breast-fed infant. The mental and physical development in the artificially fed infant is not equal to that of a breast-fed infant. The artificially fed infant is more liable to the various infectious diseases than the breast-fed infant, owing to less resistance.

The value of anti-bodies as received by the infant from the mother's milk is now commanding attention. Back-

haus gives the following table of average composition (in 100 quarts) of human milk:

Water	88.20	
Proteids	0.75	casein.
	1.00	albumin (whey proteids).
Fat	3.50	
Sugar	6.20	
Ash	0.25	

A healthy woman produces from 700 to 2000 grams (1½ to 4 pints) of milk daily. The amount of milk varies with the demands of the child in a very striking way.

Maternal Nursing.—In order to accustom the child and the mother to the procedure of nursing, the child should be put to the breast on the first day once in six hours; on the second day once in four hours. The child gets only from four to six ounces during the first two days. In some cases when an infant cries very much, a little warm water often satisfies during the first day. Should this fail, regular feeding should be begun on the second day.

Nursing habits are so very essential that regularity should be always insisted upon. It is frequently necessary to wake the child during the day, else the child will cry for food during the night. Rest for the mother is essential in the production of good milk for the child.

The following schedule as arranged by Holt is well worthy of attention:

SCHEDULE FOR BREAST-FEEDING.

Age.	Number of nursings in 24 hours.	Intervals during the day.	Night nursings between 9 P.M. and 7 A.M.
First day	4	6 hours	1
Second day	6	4 "	1
Third to twenty-eighth day	10	2 "	2
Fourth to thirteenth week	8	2½ "	1
Third to fifth month	7	3 "	1
Fifth to twelfth month	6	3 "	0

The act of sucking serves as a stimulus to the breast, and if the infant nurses too often the milk is increased in richness and hence is less digestible. Indigestion is the result. Thus a child crying from indigestion is frequently made worse by being put to the breast too often in order to stop the crying. Sufficient time should be allowed for the digestion of one meal before another is given.

The diet of the mother should not differ essentially from what would be considered to be a healthy one for her at any time. It has been shown that alcohol is devoid of influence on the mother's milk. The common prescription of beer for nursing mothers is devoid of scientific justification.

One need not jump at the conclusion that, if a suckling is suffering from dyspepsia, there is some error in the mother's food. If the mother's milk is deficient in fat, the best method of improving it is to increase her appetite and supply her abundantly with ordinary food, or give her four meals a day. As long as the fat in the mother's milk remains normal, it may be assumed that there is no great fault in the mother's dietary. The occasion will sometimes arise when maternal nursing should not be attempted. Tuberculosis, serious complications of parturition, pregnancy, and chronic diseases, etc., should be sufficient to prevent nursing. Should the choice between a wet-nurse and artificial feeding arise, the wet-nurse is greatly the superior.

The wet-nurse should be free from any constitutional taint. It is by no means essential that the child of the wet-nurse should be of the same age as the child to be nursed. It is much better to have a wet-nurse whose child is at least one month old. The condition of her child may be some indication of the quality of her milk.

Artificial Feeding. Cows' Milk.—Should maternal nursing and wet nursing be lacking, resort must be had to artificial feeding. Cows' milk is our main reliance in the artificial feeding of infants; there are, however, many difficulties to be overcome. König gives the following as the average composition of cows' milk per 100 parts:

Water	87.10	per cent.	
Proteids	3.02	"	casein.
	0.53	"	albumin.
Fat	3.69	"	
Sugar	4.88	"	
Ash	0.88	"	

There is but little difference in the analysis as given by different chemists.

Cows' milk is acid, woman's milk alkaline or amphoteric. The great difference between cows' milk and woman's milk is in the proteids, the difference being physical and chemical. From birth a calf's weight is doubled in forty-seven days. From birth an infant's weight is doubled in one hundred and eighty days. We see, therefore, that the percentage of proteids in cows' milk must be reduced before an infant can digest it. It is well to bear in mind that milk is a fluid outside of the body only, and is coagulated by the rennin present in the infant's stomach. The coagulum formed from woman's milk is soft and flocculent. As soon as cows' milk is taken into the stomach of an infant, being acted on by rennin, it becomes a solid. The clot of casein shrinks into a tough and leathery mass and offers considerable resistance to the digestive organs. The curd formed in the stomach is denser the greater the proportion of casein and lime-salts and the higher the acidity. Cows' milk contains nine times as much casein and six times as much salts as

woman's milk, and is acid. The curd formed from cows' milk is more bulky, less flocculent, and more disposed to form large clots than that formed from human milk.

Paracasein and pseudonuclein of cows' milk pass through the intestine of the infant unabsorbed. The loss of phosphorus is sixteen times as great with cows' milk as with woman's milk. Human milk contains, in addition to lecithin and nuclein, more combined phosphorus than cows' milk. The fat of both woman's milk and cows' milk is about 4 per cent. In woman's milk the sugar is 7 per cent., in cows' milk the sugar is 4 per cent., both sugars being identical in composition. The fat of cows' milk differs from that of woman's milk in that it contains large quantities of volatile fatty acids, which exist only in traces in woman's milk.

The inorganic salts of cows' milk, while the same in constituents, have entirely different proportions from that of woman's milk. Cows' milk contains a relatively larger amount of calcium phosphate and a smaller amount of potassium salts and iron oxide. A cow yields as much citric acid in a day as is found in two or three lemons.

Excess of proteids in the food of an infant produces indigestion and its accompanying results. Excess of fat will produce vomiting and diarrhea. From lack of fat, we have not enough heat. Poor digestion and nutrition and catarrh of the lungs and bowels soon follow. An excess of carbohydrates is productive of fermentation in the stomach and intestines, while a deficiency of them increases the difficulty of proteid digestion. In the adoption of cows' milk as an infant food, the physical and chemical difference between cows' milk and woman's milk makes the substitution of cows' milk a very complex

problem. Another and yet more serious problem we are confronted with in the use of cows' milk is the great quantity of bacteria present. Before cows' milk can be used as a food, certain conditions in regard to pureness must be fulfilled. The milk should be fresh, not over twenty-four hours old; it should be from healthy animals, free from tuberculosis and other taint. Cleanliness in regard to the cow, the milk-pails, and the milk-man should be strictly observed. The milk should not be skimmed or falsified. The milk should be kept on ice during the warm season in order to reduce the development of organisms as much as possible. A constant temperature of 45° F. is necessary. Experiments in laboratories of the New York Board of Health showed that good milk contains 300 bacteria to the drop after milking; when kept at a temperature of 45° F. for seventy-two hours bacteria increased to 150,000 to the drop. A sample taken from an ill-kept barn contained 2000 bacteria to the drop when taken and when kept at 52° F. increased to 16,500,000 in seventy-two hours. When cows' milk is not kept on ice in transportation from the cow to the home, the marvellous increase in bacteria will stagger our mathematical conception. Vaughan, of Ann Arbor, says that acute milk poisoning is produced by a substance more powerful and deadly than white arsenic.

The gastrointestinal mucous membrane is the largest gland in the body. In an infant one year old this gland corresponds to a tube fifteen feet long containing a suitable culture medium and little power of resistance. In instances where cows' milk is given without due care to eliminate the danger of bacteria, the flora of the intestine of the infant represents a mass of vegetable life, far in excess

of our imagination. Cows' milk is not a perfect or ideal food, but is the best we have, and, when used in the proper manner, is indispensable.

In order to destroy bacteria in milk we boil it, heat it, or pasteurize it. Boiling milk, while destroying bacteria, does not destroy toxins already formed. It renders the infant liable to scurvy. Some lactose is converted into caramel. The lactalbumin is precipitated and rises to the surface as a scum, taking with it some of the fat and caseinogen. The casein is rendered less coagulable by rennin and appears to be acted upon more slowly by pepsin and trypsin. The organic phosphorus is changed into an inorganic phosphate. Citric acid is partly precipitated as calcium citrate, and some lime-salts which are usually soluble are converted into insoluble compounds. Certain changes occur in the fat; certain neutral ferments in fresh milk, believed to be of value in digestion, are destroyed by heat. It is easy to imagine the indigestion produced by all of these changes.

There is more waste from cows' milk than mother's milk, and the stools of bottle-fed infants are more numerous and of greater bulk than in breast-fed infants. The ratio of increase in an infant fed on cows' milk and an infant fed on woman's milk is steadily greater for the infant receiving woman's milk.

In the modification of cows' milk for the use of infants, it is evident that the proteids must be reduced and the milk sugar increased. The addition of lime-water makes the milk very much more digestible. An infant only two weeks old must have a much smaller quantity of proteids than an infant of six months. No one formula, therefore, can be made, but a series of formulæ to suit the various

ages, when cows' milk must be modified. After the age of twelve months modification can usually be dispensed with during health.

During the early months the fats should be three times the proteids. About the sixth month, the fats should be double the proteids. About the end of the first year the fats and proteids should be nearly equal.

In order to secure the proper proportion of fat, the "top milk" is used. Different percentages may be obtained by varying the amount taken from the top and the length of time the milk has been allowed to stand. After milk has stood for four hours, it has been found that the upper fourth will contain nearly all the fat that will rise as cream. Using a quart jar and allowing it to stand overnight, we have a convenient arrangement. The upper third will contain 10 per cent. fat, the upper half 7 per cent. fat, granting the mixture to be 4 per cent. fat. The upper portion may be removed by a dipper, or by siphoning the bottom until the proper amount remains above. The following table as suggested by Holt is very convenient. Using the quart measure for the milk to stand overnight we see that

Removing	16 oz.,	or the upper	half,	we secure	approximately	7 %	fat.
"	11	" "	third	"	"	10	"
"	8	" "	fourth	"	"	13	"
"	6	" "	fifth	"	"	16	"

The table following (modified from Rotch) is a convenient one for altering milk for various ages. It is suitable either in health or disease and the proteids or fats can be readily varied at will.

TABLE XVI. FOR MODIFYING COWS' MILK FOR DIFFERENT AGES.

Infant's age.	Percentage of fat.	Percentage of sugar.	Percentage of proteid.	Quantity of "top milk" from a vessel containing a quart (in ounces).	Milk sugar (in tea-spoonfuls).	Lime-water (in ounces).	Boiled water (in ounces).	Number of feedings.	Amount of each feeding.
First to third day	2.0	7.0	0.25	1	3½	1½	9	10	½–1
Fourth to seventh day	2.5	7.0	0.33	1½	4	2	10½	10	1 –1¼
Second week	3.0	7.0	0.50	2¼	4	2	10	10	1½
Third "	3.5	7.0	0.75	6	7	4	18	10	1½–2½
Second month	4.0	7.0	1.0	9	8	4	19	9	2½–3
Third "	4.0	7.0	1.25	11	7½	4	17	8	3 –4
Fourth "	4.0	7.0	1.50	13	7	4	15	7	4½–5
Fifth to sixth month	4.0	7.0	1.75	15	6½	4	13	6	5½–6½
Seventh to ninth month	4.0	6.5	2.0	17	5½	4	11	6	6½–7½
Tenth to eleventh "	4.0	6.0	2.50	21	4½	4	7	5	8 –9
Twelfth month	4.0	5.5	3.0	25	3	4	3	5	9 –10

It is best to increase food very gradually. Abrupt increases are very likely to cause some derangement of the digestive organs. There are instances in which a very robust infant will be one or two months ahead of the average, so that an infant of four months would require the formula of an infant of six months. On the other hand, a small child with a rather feeble digestion may be as much behind. No schedule can therefore be followed with absolute regularity. It must also be realized that it is not possible to modify the milk in such a way as to relieve every transient discomfort or disturbance an infant may have.

In order to destroy or reduce the number of bacteria in milk, the milk can be sterilized at low temperature. The process is called pasteurizing milk. The process can also be carried on at high temperatures, but the changes

that occur in the milk impair its digestibility. The milk should be sterilized in small bottles, each bottle containing enough for one feeding. The stoppers should be loosely inserted. There are various sterilizers on the market. The temperature should be 150° F. and should be maintained from twenty to thirty minutes. This temperature is sufficient to destroy most of the organisms found in milk. The milk should be put on ice as soon as it has been sterilized.

Where no ice is available and the weather is hot, sterilization at high temperature (212° F.) is certainly safer, nor is any special apparatus needed.

In case the proteids are not digested or in cases of illness where some predigested food is needed, the milk may be peptonized. The process is very simple. One pint of fresh cows' milk and four ounces of water are put into a bottle and a powder added containing 5 grains of extract of pancreas and 15 grains of bicarbonate of soda. This is kept at a temperature of 105° to 115° F. for six to twenty minutes. It should be shaken from time to time. The process can be continued longer and all of the proteids converted into peptones. To be completely peptonized, the process should be continued for two hours. The bitter taste may be covered by lemon juice and sugar, if very objectionable. Peptonization should not be kept up any longer than is absolutely needed. The process can be gradually reduced.

CONDENSED MILK.—Condensed milk is used very extensively as an infant food. Condensed milk is simply cows' milk from which a large proportion of water has been removed. As a rule, the milk is reduced to one-third of its original volume, so that all that is necessary to restore

it to the original condition is to add twice its volume of water. Very often the cream has been removed by a separator, so that the product is condensed skimmed milk. Sugar is more frequently added as a preservative.

On the market we find: (1) unsweetened and condensed whole milk; (2) sweetened and condensed whole milk; (3) sweetened and condensed skimmed milk. Number (1) when diluted with two parts water represents a good sample of pure cows' milk. The can when opened is apt to ferment and must be cared for as would fresh meat. Number (2) contains so much sugar that when diluted with two parts water we have 16 per cent. of sugar instead of 4 per cent. as in cows' milk. When diluted sixteen times, as recommended on the can, we have 3 per cent. sugar and ½ per cent. proteid and less than 1 per cent. fat. Number (3) contains almost no fat and when diluted in the proportions recommended for infants the resulting fluid is very poor in proteids and entirely unsuited for babies' nourishment.

There is a large class of infant foods on the market. All of these foods show deficiency of fat and excess of carbohydrates. Certain types, however, may be used as adjuncts to the baby's dietary.

Other Foods.—We must remember that cereals may successfully tide over an attack of diarrhea. Of the cereals used as infant food, barley, rice, and oatmeal are more generally employed. Barley-water is a valuable food, especially in cases of milk poisoning. The grain may be used, or the flour. When the grain is used, soak the barley overnight. To one quart of water put two tablespoonfuls of barley and boil continuously for six hours, keeping the quantity up to a quart by the addition

of water. Strain through coarse muslin. The water in which the barley is soaked is not used, as it makes a barley-jelly. If the flour is used, add one even tablespoonful of the flour to each twelve ounces of water, boil for fifteen minutes, and strain. Rice and oatmeal may be used in the same quantity for rice-water and oatmeal-water. Oatmeal-water is especially good where there is a tendency to constipation.

In regard to the commercial or patent foods, the use of any such food alone is admissible only for short periods during derangements of digestion, when we wish to withhold for the time all fat and milk proteid. Such foods should not be used with condensed milk, owing to the large percentage of carbohydrates in both preparations. When added to fresh milk they may serve the purpose of milk sugar or cane sugar by furnishing the required carbohydrates.

Albumin-water is valuable in cases of stomach and intestinal disorders where an easily assimilated food is needed. The white of one egg is dissolved in eight ounces or a pint of water which has been boiled and then cooled. The solution is strained. Whey mixtures, where the casein is removed by precipitation and straining, are particularly valuable for young infants.

Koumiss is a very valuable resource in many cases of indigestion and is often retained when milk in any other form is vomited. Matzoon may be similarly used.

Beef preparations are obtained in the shops or can be prepared at home, according to the methods elsewhere described. Those on the market may be in the form of liquid peptonoids or soluble beef. For infants they must be well diluted. Beef extracts are not to be considered

in any sense as foods, as animals fed on these preparations and receiving nothing else die of starvation. Such preparations are stimulants and as such are useful. To tide over some error in digestion is their special use.

Animal broths are largely used where milk is to be withheld temporarily. They are not adapted to prolonged use and they are not very nutritious. Chicken, veal, mutton, or beef may be used. Many of these broths are so weak as to be useless.

The feeding of infants during acute illness is an important part of the treatment of every acute disease that occurs in infancy. There are cases in which forced feeding or gavage must be resorted to. The stomach should first be washed out. The intervals of feeding should be longer than is customary in health.

Mixed feeding or a combination of nursing and artificial feeding may be employed. In case the mother has not a sufficient quantity of milk or nursing is a drain on her health, mixed feeding may be necessary. Barley-water may be given in milk, modified milk, whey, or beef juice, as the case may be. In some instances an infant may be given a cracker once daily as early as the seventh month.

Weaning.—The process of weaning should be gradual; at least eight weeks are required to wean a baby. It is very dangerous to wean a baby at the beginning of summer or during the summer. By the eleventh or twelfth month the infant has usually been weaned. This brings us to the second nutritive period. From the twelfth to the thirteenth month an infant should have five meals daily.

Breakfast should consist of bread and cows' milk slightly warmed.

Lunch should consist of equal parts of oat-jelly and cows' milk warmed, seasoned with salt.

In the middle of the day broth of some kind can be given with bread.

The meal of oat-jelly can be repeated in the middle of the afternoon.

The fifth meal should consist of bread and milk, to be given late in the afternoon.

Some children cannot take bread at such an early age.

The juice of some fruit should form the regular part of an infant's diet at this age. The juice from a sweet orange or a ripe peach is best. The fruit should be given at least an hour before the milk feeding.

From the fourteenth to the fifteenth month well-boiled rice can be added to the above diet, giving five feedings in the twenty-four hours.

From fifteen to eighteen months five meals are continued daily. Butter may be given on the bread. The child may have a well-baked white potato mixed with butter and salt added to the midday meal. Stale bread is desirable, dried crisp in the oven. Now and then a soft-boiled egg. Strained oatmeal may now be given once daily. The quantity of milk should be at least a quart. The value of water must be continually borne in mind.

From the eighteenth month to the second year there should be five feedings in the twenty-four hours. One soft-boiled egg daily may become a part of the diet. One baked apple can be given at the evening meal. A peach can be given, if in season; orange juice as above stated; other fruit had best be avoided. The cereal gruels may be replaced by porridge of the same variety, but very thoroughly cooked. Oatmeal requires three hours for

cooking, and not twenty minutes, as recommended on the box. Rare scraped beef or mutton may be given if most of the teeth are through.

From the second to the third year five meals are given daily.

Milk: one quart.

Eggs: soft-boiled, one or two daily.

Soups: beef or chicken.

Meats: small piece of steak, roast beef, chicken, at midday meal.

Vegetables: white potatoes, beans, peas in purée form.

Cereals: oatmeal, rice, barley, crackers, cocoa, zweiback.

Fruit: orange, apple, peach, prunes (stewed).

From the third to the sixth year the number of feedings are usually four daily.

Milk: about one quart daily.

Cream: to be used upon cereals, upon potatoes, or in milk.

Eggs: every other day is usually often enough or the child will soon tire of them.

Meat: some meat should be given daily, mutton, beef, chicken, fresh fish. Meat should not be fried.

Vegetables: white potato, baked or with cream; spinach, peas, beans; one vegetable daily.

Cereals: oatmeal, hominy, rice, arrowroot, well cooked, seasoned with cream or milk; little sugar.

Broths and soups: nearly all varieties may be given.

Bread and biscuits: all varieties when stale.

Dessert: plain custard, rice pudding with cream, junket. To be given once a week.

Fruits: orange juice, ripe peach, baked apples, stewed

prunes, pears. Special care should be exercised in the selection of fruit during the hot months.

To be avoided: vinegar, tea, coffee, spices, wines. Ham, pork in all forms, corned beef, salted fish, goose, duck. Fried vegetables, cabbage, onions, cucumbers, beets, and green corn. Fresh bread, griddle cakes. All sweet cakes containing dried fruits. All nuts, candies (except small quantities of chocolate candy), pies, tarts, pastry of every description. All salads and preserves. Bananas, fruit out of season, and stale fruit. A child should be taught to eat slowly and masticate the food thoroughly. A child should not be forced to eat. During the summer months the amount of solid food should be reduced and the liquid increased.

The consideration of the diet of premature infants belongs especially to the subject of artificial feeding, unless the infant can nurse. The frequent nursing tends to disturb the quality of the breast milk and tends to increase the solids. The premature infant can only digest much lower percentages of proteids, sugar, and fat than is found in the normal breast. This is often disastrous to the infant, so that a normal milk may prove fatal by being too strong.

By securing two or even three wet-nurses the interval of each nursing can be made every three hours, the infant being fed every hour. In this manner the solids in the milk of the wet-nurses can be lessened. If mother's milk and the milk of a wet-nurse cannot be obtained, the system of laboratory method with low percentages gradually increased is the most rational.

PART II.

FOOD IN DISEASE.

CHAPTER XII.

FEEDING THE SICK. DETAILS OF SERVING FOOD. RECTAL FEEDING. GASTRIC LAVAGE. MEDICINES IN RELATION TO FOODS.

It must be always borne in mind that a person when sick does not lose natural characteristics, but is affected by tastes and aversions as in health. Through loss of control from weakness these may be intensified and dominate the patient, or the will may be so weakened that remonstrance is absent, or fatigue on exertion may be so great as to discourage the expression of desires, but the indifference thus evidenced is often only apparent. Especially in those diseases in which maintenance of nutrition is a matter of serious importance and often difficult must due consideration be given to the details which affect a patient's willingness to take proper food. Success in maintaining nourishment often depends upon the nurse's tact. The following points should, therefore, be well considered and carefully directed by physicians.

Appetite.—A patient frequently desires food and is very willing to take it, but has distaste for special articles offered or for the manner of cooking and serving, which

is mistaken for the lack of appetite. A certain amount of discretion should, therefore, be allowed the nurse within limits, in order that there may be proper variety. On the other hand, very definite directions regarding the articles of food allowed should be given, and all such indefinite expressions as "soft diet," "liquid food," etc., should be carefully avoided.

Regularity of Meals.—Punctuality in serving meals should be carefully observed. The habit of expecting meals at regular intervals is readily formed, and where the patient has a capricious appetite and is ready for food at the proper hour, a delayed meal will often find the appetite gone.

Quantity of Food.—Nothing more quickly destroys a feeble appetite than the sight of too much food. It should be served only in such quantities as the patient will probably eat. When aversion to food is great, a patient can often be induced to take more by offering it in small quantity and replenishing the glass, when a little coaxing will bring success. When such foods as beef-tea and milk are given they should not be too much diluted, as appetite may flag before sufficient nourishment has been taken.

Serving Food.—When a patient has been long confined to bed and denied the diversion of familiar companions, or is too weak to find interest in books, the taking of food becomes an event in his daily routine, and no details of serving are lost upon him, although, through weakness, no mention may be made. The greatest care should, therefore, be exercised in serving food daintily in clean china and glass with fresh linen. Milk should never be served in a glass that has been half used, with old milk sticking to the sides. It is best to serve food in different

kind of glasses from those in which medicine is administered, as the power of association is especially great in sick persons, and such service may lead to repulsion. In serving fluids, milk, water, etc., serve only the amount allowed. There is some comfort to a thirsty man in draining a glass, whereas it is often a hardship to have to take only a portion, and in weak persons and children such denial will often lead to marked mental distress.

Patients should never be asked what they wish to eat. It is well known that housewives and persons who provide food often eat but little at their own tables, but enjoy meals which they have not ordered, the appetite being stimulated by an unexpected dish. This mental effect on appetite is very marked in sick persons. Care should be taken that food, such as bread-crumbs, does not fall into the bed. An interval should elapse after removing vessels containing the evacuations before offering food, and perfect cleanliness on the part of the nurse should be evident. It is often well to bathe the patient's face and hands before serving meals. Attendants should never eat their meals in the sick-room in sight or hearing of the patient.

Cleansing the Mouth.—Nothing makes against appetite more than a foul, sour mouth, and the care of the mouth is most important, especially in helpless patients. When the mouth is not properly attended to, the tongue becomes coated and the whole mouth is covered with decaying remains of previous meals, which offer a ready soil for the growth of numerous bacteria. When this is swallowed it is apt to interfere with digestion by setting up fermentation in the stomach. When the tongue is coated, the taste buds are buried so that this important source of reflex

stimulation of gastric secretion fails. Hence, from every point of view careful cleansing of the mouth is imperative for good nursing. The mouth should be swabbed frequently with some good antiseptic, such as listerine, borolyptol, formolid, etc., diluted one part to two or four of water. If the tongue is heavily coated it should be scraped with a loop of whalebone and rinsed with an antiseptic solution before meals are offered. This removes the debris which covers the taste buds, and thus restores taste, improving appetite and digestion. Particular care should be exercised in cleansing the mouth when milk is administered, and the mouth toilet should always be performed after its use, as this beverage clings to the mucous membranes and sours easily.

Feeding Helpless Patients.—When a patient is to be raised to take nourishment, the pillow should be raised with the head, keeping the head and body in their relative positions unchanged, to prevent bending of the neck, which would interfere with swallowing. If fluids are to be given, the glass should be only half or two-thirds full to prevent spilling. If a tube is used, it should be bent near the centre, and it is best if the end be flattened.

Feeding Unconscious Patients.—Only liquid food should be administered to unconscious patients, and this with a spoon. It is best to give a teaspoonful at a time, and care must be taken that each spoonful is swallowed before another is administered. If the jaws are clinched, food may be well given, especially in children, through the nose. Thus it trickles down the posterior pharyngeal wall, and is not more liable to produce choking than when given by the mouth. This often disturbs the patient less than forcing open the mouth. Instead of pouring the food into

the nose from a spoon, a soft catheter, well oiled, may be passed gently through the nose into the pharynx or even into the stomach. Care should be taken, before the food is poured in, to see that breathing is not interfered with by a false passage of the catheter into the larynx.

Sleep and Feeding.—The question of waking a patient to take nourishment must be decided for each case. If the patient can drop off to sleep again easily after being aroused, it is well to administer food as often as indications direct; but sleep is frequently more necessary than absolute regularity in feeding, and in those cases in which rousing to take food materially interferes with sleep it is often wiser to omit the food than to disturb the rest.

Rectal Feeding.—Conditions not infrequently arise in which patients are unable to take sufficient nourishment by the mouth. Rectal feeding must then be resorted to. Conditions leading to this necessity are protracted vomiting, inability to swallow on account of inflammatory processes, coma or paralysis, when pain is great in swallowing, when sufficient nourishment to maintain strength is not absorbed by the stomach, or cannot pass into the intestines, as in cancer, gastric ulcer, etc.

Rectal feeding is never a satisfactory substitute for mouth feeding, as only about one-fourth of the nutriment necessary for health can be absorbed by this means. In incurable conditions rectal feeding can at best only prolong life for a few weeks. In other conditions it is of great service in sustaining a patient for a limited time while temporary affections are under treatment. Rectal feeding alone may support life from four to seven weeks, and under the most favorable circumstances as long as nine weeks.

Success depends upon three fundamental principles:

first, to keep the rectal membrane clean and free from mucus and feces; second, to prevent rectal irritation as far as possible; third, to restrict the quantity and quality of foods to such amounts and such substances as will be most completely absorbed and least stimulating to peristalsis.

Method of Injection.—Injection should be made high into the sigmoid flexure by means of a rectal tube. This tube should be about the size of a stout penholder and made of soft rubber sufficiently stiff to carry without doubling on itself, yet not so hard as to injure the mucous membrane. For children a soft catheter may be used. The tube should be passed in to the extent of ten or twelve inches, after being well lubricated with oil, but never with glycerin, as this excites peristalsis. For injection, some persons use simply a funnel in the end of the rectal tube, which, when elevated sufficiently, allows the fluid to flow in. The best means of injecting into the tube is a hard-rubber syringe. It should be held upward after filling with the nutriment and the piston should be pressed until the contents fill the nozzle in order to expel the air. A Davidson or fountain syringe may be used, but with these there is more danger of introducing air into the intestine, a thing to be avoided, as the presence of air in the rectum will cause expulsion of its contents.

The purpose of high injection is twofold: First, the sigmoid flexure offers a far larger area of contact to the nutrient material for absorption than does the lower rectum. Second, food absorbed from the sigmoid flexure is carried after absorption to the inferior mesenteric vein, and so through the portal vein to the liver, where further changes are produced before it enters the general circula-

tion; but if absorbed from the rectum, it is carried by the veins directly into the vena cava, and so escapes the changes produced by the liver.

When given a nutrient enema, the patient should be placed in bed with the shoulders low and the hips well elevated on pillows, and preferably lying on the left side, as such a position facilitates the entrance of the food and diminishes the probability of expulsion.

Cleansing the Rectum.—Success in rectal feeding depends largely upon keeping the rectum clean. At least once a day a copious enema of warm soapsuds and water should be given. A little salt added helps to remove the mucus. If the rectum is irritable and large quantities of mucus present, it is well to add boric acid to the water. Such a cleansing enema removes the remains of previous meals, frees the membrane of mucus, and stimulates the circulation, thereby increasing the power of absorption. The nutrient enema should be given half an hour after the cleansing enema has been voided.

Hemorrhoids are often a great obstacle to the administration of nutrient enemata. When they are present, great care must be taken not to irritate them when introducing the tube, and it is often of advantage to apply a 2 per cent. solution of cocaine locally.

Frequency of Injections.—The frequency and the amount of injections will depend upon the irritability of the rectum. It is best to begin with an injection of three ounces every six hours, and if the rectum is in good condition and tolerant, the amount may be increased to six or even eight ounces or the interval diminished to one every four or every three hours. Sometimes in emergencies injections of an ounce and a half every two hours

may be given, but for a short time only, as this will cause irritation and prompt expulsion if continued.

Temperature of Injections.—Nutrient enemata should be given moderately warm, say 90° to 95° F. If given very hot or cold, they are liable to excite peristalsis.

Substances Used for Rectal Feeding.—Materials which are not absorbable by the lower bowel will act as foreign bodies, producing irritation and expulsion. For this reason only such substances as are readily absorbed should be used. Raw beef juice and the white of egg, provided a little salt is added to it, are readily absorbed without predigestion. Sugar is also readily utilized, but unless in very dilute solution is apt to increase peristalsis and cause expulsion. Boiled starch is about as easily absorbed as sugar and is non-irritating. The proteid of milk is not as readily used as raw meat juice. Peptones and albumoses are quickly absorbed, and it is, therefore, of advantage to predigest proteid foods before introduction. Fats are hardly useful, and, further, do harm by interfering with absorption of other substances. On this account the yolk of egg should not be used, as it contains a large percentage of fat. The best foods, then, for rectal feeding are predigested proteids, which can be readily prepared with milk or expressed beef juice by the use of pancreatin as elsewhere described. A mixture of minced meat with one-third its amount of fresh pancreas, free from fat, has been recommended as a non-irritant nutrient. This should be beaten into a paste and sufficient warm water added to give it the proper consistence for injection. For this a large-nozzled syringe is required. The advantage of this preparation is that it may be retained from twelve to thirty-six hours.

When alcohol is to be administered by the rectum it is best given alone, well diluted, for if added to a nutrient enema undiluted, it is apt to coagulate the food and interfere with absorption, and, if diluted, it is liable to increase the bulk too much.

Aids to Retention.—Slow and careful injection of the enema will conduce to retention and the patient should be cautioned not to strain. If the rectum is irritable, a folded towel should be held against the anus for half an hour or more. If this is ineffectual, fifteen or twenty drops of laudanum may be added to the enema, or injected just previous to it, or a small opium suppository inserted. While this aids retention by checking peristalsis, it is open to the serious objection of interfering with absorption, and, further, of producing its constitutional effects. It is best, therefore, to use opium only when absolutely necessary.

Gastric Lavage.—Another procedure often useful as an aid to the proper digestion of food is gastric lavage or stomach washing.

It really belongs to hydrotherapeutics, but its uses are so closely allied to dietetics that a brief description of it here seems appropriate.

Lavage is performed with a rubber tube. This should be sufficiently soft not to wound or irritate the mucous membrane. The best form is a plain, straight tube, having a funnel at the outer end, and an eye on the side of the end which enters the stomach. The tube should be dipped into warm water, glycerin, oil, or some syrup not unpleasant to the taste to lubricate it, though water is usually sufficient. The patient's head should be bent slightly backward when the tube is passed into the pharynx

and then bowed a little forward as the tube is pushed gently past the larynx into the stomach. If gagging occurs hold a moment, and if vomiting is produced turn the tube down and let the patient vomit around and through the tube; but always keep the distance gained.

A marked degree of cyanosis may be produced by pressure on the epiglottis. In such event keep perfectly cool and tell the patient to take a deep breath. Tolerance is soon established. The tube must be measured before introduction, and the point marked to which it is to be carried, and care must be taken that it reaches into the stomach; otherwise siphonage is impossible.

In washing the stomach it is usually best to use tepid water, though in some instances very hot water is better. It should be used in quantities of a pint to a quart at a time, and washing repeated until the stomach is thoroughly cleansed. While the water is still running in, lower the funnel end of the tube and siphon out. It is often well to add an alkali to the water, and, where fermentative dyspepsia is present, an antiseptic solution. Washing with plain water should usually follow in either case.

Lavage is a great aid in treating gastric catarrh and certain forms of fermentative indigestion, since it mechanically cleanses the stomach and starts beneficial reflex effects in the alimentary canal. It is thus useful in some forms of chronic constipation. The time for giving it varies, some preferring the morning before breakfast and others bed-time.

In certain conditions, hereafter noted, the stomach tube is useful for introducing food into the stomach. This expedient, which is termed gavage, is usually undertaken

after the stomach has been cleansed by lavage, but not invariably.

Medicines in Relation to Foods.—The time of administration of medicines with regard to the preceding or succeeding meal is a matter of importance, as some drugs act differently when given on a full or empty stomach, and, on the other hand, a full stomach will retard the speed of absorption of the drug.

Alkalies should be given about half an hour before meals, unless it is desired to check hyperacidity of the stomach. Given before meals, they stimulate the flow of gastric juice.

Acids should be given within a half-hour after meals, or they may be given before meals if the acid secretion is to be checked.

Bitters and stomachics, which cause an increased flow of saliva and gastric juice by their local action on the mucous membranes of the mouth and stomach, should be given before meals.

Irritant drugs, such as iron, arsenic, etc., except in cases where the former is used as an astringent, should be given after food.

Cough mixtures, diuretics, cardiac stimulants, systemic medicines generally, are to be given between meals, as absorption is quicker and more thorough then, and their effect, therefore, more speedily established. Furthermore, there is possibility of their compositions being changed by the gastric juice during active digestion.

Remedies intended to act on the intestines and not on the stomach should be given at the end of gastric digestion, two to three hours after eating—*e. g.*, salol.

Saline purgatives should be given on an empty stomach,

preferably before breakfast. Slowly acting purgatives should be given on an empty stomach only at bed-time, when there is probability of a longer interval without food.

Cod-liver oil is best given about two hours after meals, since stomach digestion has then been established and the chyme is passing into the intestine. When given immediately after meals, a very common practice, it is more liable to produce nausea and vomiting and to interfere with the digestion and absorption of the proteids in the stomach.

CHAPTER XIII.

FOOD IN INFECTIOUS DISEASES. TYPHOID FEVER. CHOLERA. DENGUE. RELAPSING FEVER. TYPHUS FEVER. YELLOW FEVER. DYSENTERY. INFLUENZA. CROUPOUS PNEUMONIA. ACUTE ARTICULAR RHEUMATISM.

In all fevers there is more or less loss of flesh, usually proportionate to the degree and duration of the fever, being most marked when it is protracted, as in typhoid. This loss is due partly to the consumption of the body tissues produced by the febrile process, but also to the inability of the body to appropriate its proper amount of nutrition. Destruction of tissues, as evidenced by the progressive emaciation, at once suggests the propriety of liberal feeding, especially with proteids, but on account of the lessened digestive power great care and judgment must be exercised to prevent overfeeding, which would work injury to the patient. Fever diminishes secretion so that the amount of gastric juice is much less than normal. Through weakness and depression of the nerves, which fever causes, peristalsis is lessened, appetite flags or is lost, and the tongue is coated to a greater or less degree, interfering with taste. These conditions all decrease the digestive power. Further, the weakened gastric juice not only is insufficient to digest foods as normally, but its antiseptic property is also diminished, so that this material barrier against the entrance of organisms which produce fermentation and putrefaction is weakened. If more food, therefore, is given than can be properly digested by

the weakened organs, it will accumulate and undergo fermentative and putrefactive changes leading to irritation, with pain, nausea, or diarrhea.

While fevers cause a waste of the fat of the body, this is not so rapid a process as the destruction of albuminous tissues, which is often extreme, as is shown by the marked increase of urea eliminated, amounting often to forty or fifty grams above the normal in a day. This slower loss of fat may prove deceptive as to the actual degree of waste present if one judges only by the appearance of the patient. The increased elimination of the salts of potassium further points to a relatively increased destruction of muscle tissues. This process affects the involuntary muscles as well as the voluntary, thus further diminishing the digestive power of the fever patient. Under such conditions it is, of course, impossible to build tissues, but by the liberal administration of proteid food the waste of the body tissues is lessened, the food undergoing combustion instead.

In remittent and intermittent fevers the question of nutrition is simpler. During remission and intermission the tissues recover somewhat their power to appropriate food, which was greatly diminished or lost during the febrile period. Advantage is taken of this to feed more abundantly during these periods in order to maintain strength. In fevers of short duration, even where the temperature is high and loss of flesh rapid, as in pneumonia with early crisis, anxiety need rarely be felt with regard to the maintenance of nutrition, unless old age or great debility complicates the condition; and where appetite is lost and there is great aversion to food, it is often well to respect the patient's wishes.

The organs of elimination share with other organs of the body in the functional weakness produced by fevers.

There is sometimes danger of such an accumulation of waste products that these organs will be unable to meet the demand thus put upon them. Therefore, in fevers it is necessary to give only foods of such character as will produce little waste and tend to aid elimination.

It is almost universally admitted that only fluid foods should be given fever patients. The loss of function of the stomach is far greater than that of the intestines and often practically amounts to cessation of gastric usefulness. Under such conditions the food would pass more or less unmodified through the stomach; hence, in giving solids there is danger of producing irritation and consequent loss of function in the intestines, upon the proper performance of which the patient's life depends.

The principles underlying the rational dietetic treatment of fevers are, therefore: first, to feed the patient as liberally as is consistent with safety in order to check albuminous waste and retain strength; second, to select such foods as are readily digested and absorbed, on account of the diminished power of the digestive organs; third, to select foods that will produce the least possible strain upon the organs of elimination. And it must constantly be borne in mind that there is no appropriate routine in diet any more than in the use of drugs, but that the diet must be suited to the patient's digestive ability and intelligently varied to stimulate appetite and digestion.

Typhoid Fever.—In this disease the state of appetite is never to be taken as an indication of the patient's need for food. During the first few days of the disease the appetite is diminished and capricious, and the foods, always liquid, must be varied in order to induce the taking of more nourishment. After a few days the appetite is usually lost and the patient frequently is somnolent and

indifferent to food. Variety then ceases to be of importance and the food best digested should be adhered to. In convalescence the appetite becomes voracious, demanding solid food and abundance of it, rather than marked variety. Great care must be exercised in indulging the patient's demands. Until convalescence is well established the diet should be limited to the following liquid foods:

Milk.—As this is a complete food, furnishing all the necessary materials for the use of the body, its advantages are at once apparent. It is nutritious, easily procured, cheap, convenient for administration, and to most persons palatable and digestible. These very advantages are liable to induce one to overlook certain objections. It is too often given as a matter of routine, for it should not be forgotten that many persons cannot digest milk. Another important fact for consideration is that, though milk is administered as a fluid, it coagulates in the stomach into large, firm curds, or, in other words, is there converted into a solid food. When digestion is feeble, these curds often pass through the digestive tract unaltered and are visible in the stools. Under such conditions the food fails of its purpose to nourish the body, and acts as a mechanical irritant to the inflamed and ulcerated intestines, thus doing positive harm and further increasing the intestinal disturbance. When milk is administered in typhoid, the stools should be carefully watched for this curd, and with its appearance the milk should be withheld, reduced, or modified. The curd often appears in large pieces, but it sometimes occurs in minute particles which require the closest examination to discover. Great care must therefore be taken in observing the stools.

It should be remembered that the digestibility of milk

may be increased in various ways; boiling, diluting with water, or, better, with some alkaline or effervescent water, equal parts, will often be sufficient to render it digestible. Lime-water, one ounce to three or four ounces of milk, is often used, but from recent experiments it is claimed that lime-salts ingested with the milk increase the coagulability of the blood and the danger of thrombosis. Citrate of soda, twenty to forty grains to the pint, has been suggested as a better means of neutralizing the acids.

Many patients object to milk on account of its taste. Its palatability may be improved by the addition of various flavors, such as sweetening with grape sugar or milk sugar; the addition of coffee, tea, or cocoa; or the use of wine, brandy, or whiskey as flavoring agents, if not contraindicated by the patient's condition. Fruit juices are often serviceable for a like purpose. Many of the prepared infant foods are useful, added to milk, as they mechanically prevent the formation of large curds, thus increasing its digestibility, besides adding more nutriment. Many persons who object to the taste of milk will take it willingly in the form of ice-cream, even when it is not flavored. This is a matter of some importance, since it is often unwise to add flavoring materials to milk in order to make it palatable. Ice-cream may be given several times a day, and often proves more refreshing than milk. It should for evident reasons be administered slowly. When milk is the prescribed diet, two to three pints in twenty-four hours are sufficient under ordinary circumstances. A generally convenient manner of administration is to give four to six ounces every three hours, though conditions may render it necessary to administer in smaller amounts at shorter intervals.

Variety in a milk diet may be secured by using its different preparations. Buttermilk is an excellent substitute, and contains all the nutriment of milk except the fat, its percentage of proteid being greater. For many persons it is more digestible than milk, as it is not liable to make large curds. Whey is another useful substitute when milk disagrees; it contains much of the salts and sugar of the milk and the soluble albumin. Junket and koumiss are often useful. When plain milk disagrees, it may be predigested with pancreatin, partially or completely.

Because of the danger of intestinal irritation by curd and the liability to fermentation of milk, many physicians now exclude it from their typhoid dietaries.

Eggs.—These constitute another complete food most useful in the typhoid dietary. The preparation most commonly in use is egg albumin, or albumin-water, which is made by beating the white of egg with an equal quantity of water, straining, and flavoring. Lemon, orange, and grape juices are useful flavoring agents for this preparation. The whole egg may be beaten with boiling water, strained, and sweetened; though some practitioners object to the use of the yolk of egg during the febrile period. With many patients the yolk seems prone to undergo fermentation, increasing distention. When the whole egg is permissible, it may be given as a soft-boiled egg, if its consistency be not firmer than jelly. When alcohol is used in typhoid, it may be mixed with egg in the form of egg-nog as a palatable and nutritious method of administration.

Soups and Broths.—Care must be taken not to administer proteid foods in too concentrated form. Meat extracts

and infusions are useful as stimulants to appetite and digestion, lessening the risk of exhaustion and supplying a large amount of saline material, thus replacing the deficiency caused by pathological elimination. Soups and broths made from beef, lamb, chicken, veal, mutton, oysters, and clams are suitable, and may be thickened moderately with various cereal gruels and flavored with expressed vegetable juices, like celery, or those of aromatic herbs, like thyme; these should be carefully strained.

Gelatin.—This is of undoubted value as a tissue sparer, lessening proteid waste. It is readily digestible, and by flavoring in various ways makes a most palatable variation in diet. It should be given in moderate amounts, as excess will cause diarrhea and tympanites. Its use has been recommended when hemorrhage is present. It is then given in two to four-dram doses of a preparation made by adding one-half to one dram of commercial gelatin to one pint of water.

Proprietary Preparations.—Many of these are on trial and seem to serve a useful purpose. Among them may be mentioned Somatose, Plasmon, Panopeptone, Liquid Peptonoids, and various meat extracts. Valentine's Meat Juice, a preparation undoubtedly rich in nutriment, is much used by English physicians, by whom it is highly valued because of its prompt absorption from the stomach without leaving waste which might irritate the intestines. For this reason they make special mention of it as a useful food when hemorrhage occurs in typhoid, patients being supported by it as the only food for a week or more.

Carbohydrates.—These are useful as tissue savers, and may be given in the form of gruels made of oatmeal, barley, rice, wheat, tapioca, or sago, carefully strained.

These foods should not be used with milk and eggs in the form of puddings. Gruels may be flavored with various spices, orange or lemon peel, and salt, or they may be sweetened. Barley-water and rice-water contain very slight amounts of carbohydrates, but are useful as beverages. Grape sugar and milk sugar are easily assimilated forms of carbohydrates. They should be given well diluted, usually as sweetening for various beverages.

Beverages.—An abundance of water is essential for fever patients. Instructions should be given for the regular administration of water just as for nourishment, and nurses should not wait for a patient to ask for it before offering. Water increases the elimination of waste products from the blood and prevents concentration of that fluid. It raises blood pressure and increases kidney activity. It dilutes the noxious materials in the blood and lessens their irritating and depressing effects upon the nervous system. In severe cases when coma or delirium prevents the ingestion of sufficient water by mouth, it may be well given by rectum; when thus administered it is well to add a little salt. If the rectum becomes irritable so that the water is not retained it can be given with advantage subcutaneously. In this case normal saline solution should be used.

In giving water by mouth it is best, when practicable, to give the kind of water that a patient is accustomed to. If it is preferred with lemon or orange juice or unfermented grape juice, sweetened with grape sugar or milk sugar, there is no objection, and by thus flavoring, many patients will be induced to take an amount of water otherwise impossible. Coffee, tea, and cocoa may be given when the patient is accustomed to them and no contraindication exists.

The use of alcohol, which was formerly employed most liberally in typhoid, is becoming more and more restricted. Opinions differ as to the degree of its usefulness, many physicians not prescribing it at all. It is generally agreed, however, that its use as a routine measure is unjustifiable and that, if given, it should only be in the face of evident and positive indications.

Solid Feeding.—This is the term applied to a new plan of treatment advocated by some of the leading practitioners of to-day, and upheld by extensive clinical and hospital statistics. In addition to the above fluid dietary, they also use throughout the entire course of the fever soft, non-irritating, easily digestible solid food, such as scraped beef, meat pulp, minced chicken, oysters, crackers, bread, creamed potatoes, and custards. Though advocated by distinguished men who practise it, solid feeding has not as yet been accepted by the profession at large.

Statistics were recently completed in the Massachusetts General Hospital which showed a comparison of one thousand cases nourished by liquid diet with one thousand cases which received solid food throughout. The mortality was slightly lower among those who received solid food and their comfort was greater. With the multiplication of such evidence, it is probable that material alterations will soon prevail in professional opinions concerning nutrition in typhoid.

Mouth Toilet.—Since it is recognized that the maintenance of nutrition is the most important part of the care of a typhoid patient, every measure which tends to this end should be assiduously pursued. No single useful measure is attended with such gratifying results as is a thorough and continued mouth toilet. By attention to

this the distressing fermentation, which may develop a paresis of the intestinal walls with threatening tympanites, may be forestalled. Food can be administered with much less difficulty when the mouth is kept clean, many patients even maintaining appetite throughout the course of the disease. Marked effect is often evident in the general condition of the patient after mouth cleansing has been properly instituted, as is shown by lessened fever, clearer intellect, and a moist, soft tongue. A good routine is to cleanse the mouth before and after every feeding by scraping the tongue and buccal surfaces with a loop of whalebone and then swabbing out thoroughly with antiseptic solutions, as described on page 225.

Diet in Convalescence.—Considerable difference exists in the judgment of physicians as to the time to begin solid feeding. It is better to err on the safe side, although each day's delay is a great trial to a hungry patient, than to feed too soon and subject him to the danger of relapse. The diet may be increased in quantity three or four days after the evening temperature becomes normal, but solid food should be withheld until the tenth day thereafter. The transition from liquid diet to solid feeding must be gradual. Beginning with very soft-boiled eggs or milk toast, such articles may be added day by day, as scraped beef, custards, stale bread, hard-boiled yolk of egg, minced chicken breast, then baked or mashed potato, chops, and thus a gradual return to the regular diet in the course of three weeks. Any rise of fever will necessitate an immediate return to liquid diet.

An occasional exception to the rules of feeding just laid down occurs in those debilitated cases which after a protracted course continue to have a low fever after the

typhoid state and typhoid stools have entirely disappeared. This is known as inanition fever and requires feeding. Increasing the diet with semisolid foods, such as milk toast, soft-boiled eggs, etc., will in these cases hasten the cessation of fever. These foods should be given during the normal period of temperature, liquids being continued while fever is present.

Cholera.—The infection of cholera is always transmitted by water and gains entrance to the body by the mouth. From this fact it will be readily understood that cholera may be largely prevented. Great care should be observed in the disinfection of stools and vomitus, as well as of all clothing, bed-linen, and utensils used about the patient, in order to prevent contamination of the water supply and transmission of the disease.

Prophylaxis.—No uncooked food of any kind should be eaten, such as celery, lettuce, and fruits, as there is danger of contamination of such articles by the water used for washing them. All water used for cooking, drinking, and such toilet purposes as cleaning the teeth, should be sterilized by boiling and well protected thereafter from possible contamination. Water and milk may be cooled after sterilization by placing their containers on ice, but under no circumstances should ice be allowed to come into direct contact with foods or drinks, as the ice is liable to be infected. The comma bacillus, which causes cholera, does not thrive in an acid medium. Acid drinks are therefore beneficial, and the liberal use of lemons and limes with the addition of sulphuric acid is of advantage, as it tends to check the growth of the bacilli in the stomach, and, if used frequently, considerable acid will pass into the intestines, lessening the possibility of the development

of the bacteria there. Care must be observed during an epidemic with regard to food, and all articles of diet which are apt to produce indigestion, such as pastries, must be carefully avoided, as gastric disturbances which permit food to undergo fermentation in the stomach increase the danger of infection. Overeating must be carefully avoided, and only very moderate amounts of food taken. The manner of cooking food is also of importance for the same reason, and fried articles are best excluded. Thorough cleanliness on the part of attendants is imperative. After handling the patient or removing the dejecta, the hands should be sterilized and thereafter washed with soap and water. Attendants should never eat in the patient's room, and should be scrupulously careful about disinfection before eating.

Treatment.—Vomiting and profuse serous diarrhea are the characteristics of this disease. Vomiting is aggravated by food, and, when extreme, precludes the administration of nourishment by mouth. In the early stage of premonitory diarrhea, milk, whey, or gruel may be given in very small quantities, a few teaspoonfuls at a time, if it can be retained. The use of the stronger albuminous foods, such as meat juice and extracts, is not advantageous, as these form an excellent culture medium for the bacilli. Acid drinks are to be used freely, as in prophylaxis. When the serous diarrhea begins, and while the disease is at its height, food is useless, as it will not be retained. The loss of water by diarrhea and vomiting is enormous and rapid. This produces great emaciation and violent cramps, the patient speedily collapsing. The blood is concentrated and filled with toxins which are the real cause of collapse. The need of water, therefore, is imperative to supply the

drained tissues and to dilute the toxins in the blood, so as to lessen their irritant and depressing effects on the nerve centres. The liberal use of water hastens the toxins to the organs of elimination and aids in their removal. Enteroclysis, or the introduction of water high into the intestine, is one means. For this a rectal tube should be used and about two quarts injected hot, very slowly. It is well to add a little boric acid or salt, as this will often relieve the tenesmus. By this means the bowel is cleansed and many bacilli are washed out. Some water is also absorbed, although the process is slow and imperfect and largely prevented by the diarrhea.

Another method of introducing water, which gives prompt and impressive results, is intravenous injection of saline solution. While efficient, the method is a dangerous one, on account of the possibility of sepsis or the introduction of air into a vein, with embolus formation and its results.

The more usual method to-day, which, while less prompt is more lasting, is hypodermoclysis, the introduction of water into the loose subcutaneous tissues. For this purpose normal saline solution should be used, which may be prepared with sufficient accuracy by dissolving a heaping teaspoonful of salt in a quart of sterilized water. Five to fifteen ounces may be injected several times a day. It should be given at a temperature of about 100° F., and is imperatively demanded when the algid stage develops. Hypodermoclysis may be readily practised with a fountain syringe and a small aspirating needle. Thorough aseptic precautions must be observed and the introduction must be made slowly into the thighs or the side of the abdomen.

The intraperitoneal injection of hot milk has been

recommended as a means of introducing water and nourishment, but the value of this procedure is as yet undetermined.

As vomiting diminishes and recovery begins, teaspoonful doses of milk or broth may be tentatively given. If retained, the administration may be repeated every fifteen or twenty minutes, and after some hours the quantity may be increased and the interval extended. The stomach and intestines are apt to remain irritable for some time. After vomiting and diarrhea have ceased, the diet of convalescence should be like that of typhoid fever.

Dengue.—This is a mild fever and runs a comparatively short course. While fever exists, diet should be like that of typhoid, but convalescence in this disease is much more rapid than in typhoid and there is no ulceration of the intestines, so that return to solid feeding may be made much sooner.

Relapsing Fever.—Diet during this fever is to be regulated like that of typhoid. It is well to adhere to absolute milk diet if jaundice is present. After the fever subsides, return to regular diet may be speedy.

Typhus Fever.—During the fever the diet should be like that of typhoid, but since the disease is shorter than typhoid and intestinal lesions are absent, solid food may be given sooner in convalescence. The stomach should be spared as much as possible, however, and small quantities of food given at frequent intervals to avoid overloading. In some instances, when vomiting is severe, rectal feeding must be resorted to for a short time.

Yellow Fever.—In this disease vomiting is a marked and violent symptom, which is increased by the administration of food. It is, therefore, best to withhold all

food for the first two or three days, unless prostration is extreme, when attempts may be made to give food in very small quantities. The continued vomiting greatly lessens secretions, and water is essential to restore glandular function and maintain kidney activity. It cannot be retained by the stomach, so must be administered by enteroclysis or hypodermoclysis, as in cholera.

Following the turbulent onset of the disease comes a period of calm when all symptoms abate. Some take advantage of this period of remission to feed by mouth, but if it is done extreme care should be observed, as the stage of calm is followed by a second rise of fever and violent return of all previous symptoms, which will be aggravated if the stomach has been overtaxed. It is probably safer, even during the period of calm, to restrict nourishment to rectal feeding, for which pancreatinized milk and beef juice are to be used. After all symptoms have abated mouth feeding may be resumed, but the diet must be liquid for ten days or two weeks, as the stomach remains very irritable for some time and fatal relapses have been produced by the too early use of solid food. Soft foods may be given in ten days to two weeks after convalescence begins, and thereafter the diet should be regulated as for typhoid fever. When albuminuria is present, highly albuminous foods, such as meat preparations and eggs, must be withheld.

Dysentery.—Mild cases of this disease may often be satisfactorily controlled by diet, but imprudence in diet may cause severe exacerbations or relapses. During the first day or two of the disease it is well to give little or no food, as this relieves the stomach, lessening its irritability by rest, and permits a thorough cleansing of the

bowel, which could not be accomplished if food were regularly administered. Discretion must be used in the selection of foods in dysentery, and only such kinds prescribed as will leave little residue, which in the inflamed condition of the intestine would readily undergo fermentation. Absolute milk diet is preferred by some physicians. Meat juices and eggs are allowable and egg may be given soft boiled or soft poached. In severe cases farinaceous foods are to be withheld, as they leave a large residue and readily ferment. Demulcent drinks, such as barley-water and rice-water, or flaxseed tea, may be given, flavored with lemon juice.

In convalescence raw oysters, or the breast of squab or chicken, are good solid foods to begin with. Stale bread and crackers may then be allowed. For the extreme emaciation which develops in some cases inunctions of cod-liver oil or olive oil have been recommended.

Influenza.—This disease is characterized by profound depression out of all proportion to the intensity of the symptoms. Abundant nourishment is, therefore, imperative. In mild cases articles of soft food, such as soft-cooked eggs, raw oysters, jellies, milk toast, etc., may be given. In severe cases the food must be restricted to liquids of the most digestible character. When vomiting is severe mouth feeding may become difficult. Unfortunately diarrhea often occurs at the same time to such an extent as to preclude rectal alimentation. Under such conditions abstinence for twenty-four hours may check vomiting and is permissible if the patient is robust. If the patient is weak, however, and especially in old persons and children, it would not be safe to withhold food, and milk or meat extracts must be given in small amounts

frequently—say, a teaspoonful every fifteen minutes to half an hour.

Prostration continues long into convalescence and the most nourishing foods are necessary. Beginning with soft-cooked eggs, raw oysters, and scraped beef, solid foods may be gradually added, such as breast of chicken, fish, and farinaceous foods. Tea and coffee are useful stimulants. Such fruits as cooked apples, stewed prunes, oranges, and grapes may be given. Food should be administered in small amount at short intervals until strength is well regained.

Water should be taken freely throughout the course of the disease and especially in convalescence.

Croupous Pneumonia.—Foods should be limited to liquids as a rule. Though milk will form the basis of diet, broth, soft-cooked eggs, custards, and gruels may be given. Care must be taken to avoid such foods as may ferment in the stomach, for distention of that organ with gas would materially interfere with respiration. The disease is usually of short duration and feeding is not often a difficult matter. Sometimes in delirium all foods will be refused and it may be necessary to nourish by rectum. In very mild cases soft foods, such as milk toast, beef pulp, and jellies may be given with propriety. In cases with delayed crisis, in which the fever hangs on, feeding must be carefully conducted along the lines laid down for typhoid fever. As in that disease, mouth cleansing is of importance.

The febrile albuminuria which occurs commonly in this disease does not require special treatment, but if nephritis develops the diet should be limited to milk.

Water should be given freely throughout the course of

the disease as in other infections. Lemon, orange, and grape juice may be used liberally. The free use of alcohol was at one time the recognized practice in the treatment of pneumonia, but it has been entirely abandoned by many practitioners. There is no indication for which it was given that cannot be better met with other drugs.

Acute Articular Rheumatism.—Though it was formerly taught that this disease was due to perversion of nutrition, a view still held by some, it is more and more generally believed to be an infectious disease. Its general management is in many respects similar to that of typhoid. During the febrile stage milk is the best diet, since, besides supplying nutriment, it stimulates the kidneys. If milk cannot be taken, broths and gruels may be used. Egg preparations, such as are used in typhoid, may be substituted. Acids are usually craved, and may be given in the form of lemonade and oranges. Alcohol, tea, coffee, cocoa, and chocolate should be excluded from the diet. As convalescence proceeds, farinaceous foods may be added, such as milk toast, boiled rice, arrowroot, oatmeal, etc. The increase in diet should be very gradually made and meats should not be eaten for some time, since too early indulgence is liable to bring on a relapse. When they are allowed, oysters, fish, and chicken breast should be first tried, and, later, other meats. While on liquid diet the patient should be fed in moderate amounts at frequent intervals, say every two hours, but in convalescence the quantity may be gradually increased and the intervals lengthened. Throughout the disease water should be freely given.

CHAPTER XIV.

FOOD IN INFECTIOUS DISEASES (*Continued*). MALARIA. SEPTICEMIA AND PYEMIA. ERYSIPELAS. SMALL-POX. SCARLET FEVER. MEASLES. DIPHTHERIA. CEREBROSPINAL MENINGITIS. WHOOPING-COUGH. PULMONARY TUBERCULOSIS.

Malaria.—In intermittent malaria the paroxysms are of such relatively short duration that feeding may be suspended unless the patient is very feeble. During the nausea which usually accompanies the chill it is best to withhold food, but if the patient is weak during the fever which follows, milk or broths may be given. Water should be given freely and during the intermission return may be made to solid foods. In convalescence anemia is present and constipation is frequently an annoying sequel. A generous diet of meats and fresh vegetables is therefore indicated.

Remittent fever should in general be treated dietetically like typhoid as to quantity and frequency of feeding. As, however, intestinal ulcers are absent in this disease, semi-solid foods, such as custards and farinaceous foods, may sometimes be given. Acid fruits and water should be frequently used to aid in elimination. The use of alcohol is rarely, if ever, necessary, and the common custom in malarial districts of using it in large amounts is an error. In convalescence prostration and anemia are met with. A generous mixed diet with abundant meats should be given. The free use of water should be encouraged to dilute the increased nitrogenous waste.

In **malarial cachexia** digestion is far below normal, appetite poor, and vomiting a frequent and often persistent symptom. The diet should be restricted to the most nutritious liquid foods and given in small amounts frequently. It may even be necessary to resort to nutrient enemata. When there is no vomiting, soft diet may be given, including such articles as minced meats, raw or rare; oysters, clams, stewed fruits, and milk toast, but caution must be exercised not to overfeed, in order to avoid inducing vomiting. Water should be freely given, and as the condition improves and convalescence is established, the diet should be increased as in other forms of malaria.

Septicemia and Pyemia.—These infections markedly impair digestion and consequently produce great loss of appetite and strength, with wasting of the tissues. The drain upon the body is great and food of easy digestibility should be abundantly provided and pushed in quantity as far as the stomach will tolerate. The diet should be liquid, consisting of milk, broths, and gruels. The more chronic the condition, the greater the need of food, and in prolonged cases with continued suppuration solid food must often be given. When the stomach is intolerant of the necessary quantity, mouth feeding must be supplemented by nutrient enemata. Water must be plentifully administered by mouth if possible, by rectum and hypodermically if necessary. The conditions often show remissions, during which food can be increased. Stimulants are often necessary and are well borne. If nephritis occurs, diet must be modified accordingly. In convalescence a gradual return to normal diet should be made in the usual manner.

Erysipelas.—In mild cases it is not necessary to adhere rigidly to liquid diet, but such articles of soft diet as oysters, farinaceous foods, custards, milk toast, etc., may be used, and the patient should be abundantly fed with such readily digested articles. If fever is high, however, or if swallowing is difficult on account of pharyngitis from extension of the inflammation or because of pressure of affected cervical glands, liquid diet must be adhered to. Rarely the difficulty of swallowing may be so great as to necessitate rectal feeding. Water must be abundantly supplied, as in other infections, to aid in elimination and prevent a complicating nephritis. If swallowing is interfered with, water must be supplied by rectum or hypodermically. Alcohol is usually recommended and can be taken in large doses, especially in aged or debilitated persons and young children. In convalescence abundant nutritious diet should be given and a gradual return made to the normal.

Smallpox.—Sudden high temperature with marked anorexia and thirst characterize the onset of this disease. Vomiting may occur, but is not frequently of sufficient degree to interfere with nutrition. If present, it usually ceases with the appearance of the rash. The rash may be so profuse on the mucous membrane as to make swallowing difficult and materially interfere with nutrition by mouth. As in all fevers of intense degree, albuminuria may occur, and occasionally nephritis may complicate. Cool water should, therefore, be given abundantly in order to lessen the patient's suffering and to avert nephritis by diluting the waste products and keeping the kidneys well flushed. During the febrile period liquid diet should be the rule, such articles as milk, broths, and raw egg being used. If albuminuria super-

venes, all albuminous foods must be discontinued except milk, and farinaceous foods substituted. If swallowing is rendered difficult by sore throat, food must be given in very small amounts frequently. Ice-cream can often be swallowed when it is impossible to use milk. If irritation of the throat is very great it may be necessary to resort to rectal feeding. When pustulation occurs, prostration is profound, and it may even be marked during the vesicular stage. Abundant nourishment is, therefore, imperative and should be given, from the outset of the disease, to the full extent that the stomach will tolerate, though due care must be observed to avoid overfeeding, which would derange the gastric function. In convalescence the gradual return to the usual diet is to be made, beginning always with soft diet, such as custards, soft-cooked eggs, raw oysters, etc. When albuminuria or nephritis has complicated, the use of meats should be delayed.

Scarlet Fever.—During the febrile stage liquid diet should be abundantly supplied and water and lemon juice freely given. Milk and gruels are the best foods to use. Liquid diet should not be discontinued immediately on the fall of the fever, but should be uninterrupted until after desquamation is well advanced. Patients are often ravenous during desquamation, but nephritis is such a dangerous and common complication that special caution is necessary to prevent its development. Albuminuria at the time of maximum temperature is common, but true nephritis does not usually develop until in the second or third week. Exposure during desquamation is no doubt a factor in producing nephritis, but the more common cause is indiscretion in diet. During this period the eliminative function of the skin is crippled so that more

work is thrown on the kidneys, which may be easily overwhelmed by an incautious use of nitrogenous or solid foods. Milk is the best diet and it has been claimed that an absolute milk diet is an efficient preventive of nephritis. In this disease the throat is frequently so sore as to preclude nourishment by mouth on account of the pain on swallowing. In such cases rectal feeding must be instituted and water plentifully supplied by rectum or by hypodermoclysis. If milk for any reason cannot be continued, it may be peptonized or substituted by koumiss or whey, and farinaceous gruels added to the diet.

As convalescence is established, farinaceous foods and fruits, such as lemons or stewed apples, may be added to the diet. After the third week oysters, clam broth, squab, and chicken may be gradually introduced and return to normal diet cautiously made. While food should be sufficiently abundant to maintain the strength, it is a mistake to push nourishment too far and good judgment must be used in order not to give too much food. When nephritis develops, the diet is to be regulated as for that condition.

Measles.—While fever lasts the diet should be liquid, consisting of milk, broths, meat juice, raw eggs, and gruels. Lemons and oranges are refreshing and water should be abundantly supplied. Digestion is retarded and diarrhea is frequently present. Care should be observed, therefore, not to give solid foods too soon. If enteritis is marked, it is best to discontinue milk and rely temporarily on gruels for nourishment. In infants the nourishment should be in smaller quantities, more diluted and more frequently given than what is usual at the child's age. Stimulants are rarely necessary, unless the patient is very

feeble when attacked by the disease. Bronchopneumonia is a not infrequent complication in convalescence. In hemorrhagic measles albuminous foods should be withdrawn, except milk, in order to lessen strain on the kidneys. In convalescence return to solid food should be quite gradual if enteritis or diarrhea have been present, otherwise the return to solid food may be prompt.

Diphtheria.—Maintenance of nutrition is often difficult on account of the pain produced by swallowing, and young children are particularly hard to control. As long as they can be induced to swallow, mouth feeding should be practised, and when sufficient nourishment cannot be thus taken, rectal feeding should be instituted. Forced feeding through the stomach tube or nasal tube is dangerous, as it is liable to make abrasions in the mucous membrane. The foods should be liquid and sufficiently varied to tempt appetite. Ice-cream is a good form in which to administer milk and can often be swallowed with much less pain than plain milk. Water should be given freely in order to lessen the intensity of the toxemia by diluting the toxins and hastening their elimination. When sufficient water cannot be taken by mouth it should be administered by rectum, or normal saline solution may sometimes be injected subcutaneously. If albuminuria develops, the proteid food should be restricted to milk. Soft farinaceous foods and soft-cooked eggs should be given whenever the patient can take them.

When intubation has been performed, soft foods can usually be taken better than liquids. The latter can usually be administered, however, if the patient is fed while lying on the back with the head low or turned to one side. This position lessens the possibility of food

entering the tube, and it should be maintained until all food has been completely swallowed before lifting the patient.

In postdiphtheritic paralysis swallowing is performed with much difficulty, but enough food can usually be given to maintain life if it is administered very slowly. When it proves impossible to do so, feeding must be accomplished by the use of the stomach tube.

Cerebrospinal Meningitis.—Proper nutrition is a potent factor in this disease. In severe cases when convulsions, delirium, and coma are present, liquid foods must be administered with great care. They should be given in small, frequent doses, as little as a teaspoonful being administered every fifteen minutes in some instances. Recourse to rectal feeding may be necessary, though this procedure is frequently precluded by diarrhea. In the milder cases and as long as the patient can swallow, soft foods as well as liquid may be administered. Water should be freely given. During the convalescence the appetite is usually good and an abundance of nutritious foods should be supplied. Five or six meals a day would not be too many. Good meats, bread and butter, and cereals are to be allowed as soon as they can be digested.

Whooping-cough.—In mild cases of whooping-cough no special dietary restrictions are needed further than withdrawing specially unwholesome articles of food, such as pastries, pickles, etc., but in the severer cases the question of maintaining nutrition may become serious on account of the vomiting produced by the paroxysms of cough. Great care should be taken, even in mild cases, to avoid overloading the stomach. Food should be given in small quantities at frequent intervals, and in the

severer cases readily digested food should be kept accessible and a little given after each paroxysm. If the attack is so severe that all food is vomited, rectal alimentation will have to be instituted. Liquid and soft foods are the best to use, such as milk and its preparations, eggs, beef juice and broths, custards, fruits, and prepared foods. As in other infectious diseases, water should be given freely.

Pulmonary Tuberculosis.—There is no disease in which nutrition is of greater importance than in this. Emaciation is progressive and often rapid. It is necessary not only to supply nutriment to meet the ordinary demands of wear and tear and force production, but this waste must be checked and if possible flesh must be increased. In other words, more food must be given than is necessary simply to arrest the loss of flesh, as the tissues must be nourished and strengthened to prevent the inroads of the disease. Cornet suggests that the rapid waste of the tissues hastens absorption of the proteids surrounding the tuberculous foci, thus inhibiting the process of healing and furthering distribution of the bacilli. Hence, forced feeding, by preventing these conditions, is a positive aid to cure. When it is recalled that 3000 calories per day are necessary for a healthy adult, it is evident that in the presence of a condition of increased metabolism, such as one finds in tuberculosis, an excess of food becomes essential. All classes of food should be given, but the form of administration must be varied according to the patient's ability to digest them. No routine dietary will be satisfactory; the food must be modified for each person, and in individual cases according to the changing conditions present.

When the patient has no fever and digestion is not

impaired, the usual dietary for healthy adults is to be taken as the basis for feeding. Special attention should be given to providing variety in the diet, as this does much to forestall loss of appetite and digestive disturbance, which materially increase the difficulties of treatment when they occur.

Substances which are liable to derange digestion, such as pastry, pickles, and sweets in excess, must be excluded from the diet. Fats and carbohydrates must be freely given, as their combustion spares the albumin, and proteids must be freely used to replace the wasting tissues and to increase structural resistance.

A type of dietary would be as follows:

7 A.M. (or on awakening).—A glass of hot milk flavored with tea or coffee; or cocoa, if desired; or milk and raw eggs, or beef-tea.

About 9 A.M. (breakfast).—Cereals with rich cream and sugar; soft-cooked eggs, boiled or poached; fresh fish or meat; breakfast bacon cooked crisp; bread or toast, with butter, fruit, stewed fruit, or marmalade. With this may be taken tea or coffee with milk.

About 11 A.M. (lunch).—A glass of milk, milk and egg, buttermilk, or gruel.

At 1 or 2 P.M. (dinner), consisting of soup; meats, such as beef, mutton, or fowl; fish; easily digested vegetables, such as baked potatoes, spinach, asparagus, rice, macaroni, peas, salads with oil dressing, and stewed or ripe fruits.

About 4 or 5 P.M. (lunch).—A glass of milk, milk and egg, a cup of broth, or a plate of ice-cream or jelly.

7 P.M. (supper).—Fruits, ripe or cooked; cereals, bread and butter, milk, and tea or coffee well diluted with milk.

About 10 P.M. (at bed-time).—A lunch similar to those served at eleven and four.

It is of advantage in helping digestion if the patient will rest, lying down, for twenty minutes or half an hour before and after the three heavy meals.

When fever is present, material alterations must be made in the form of the diet. When the temperature is continuous or high, nutrition must be secured by such measures as are used in acute infectious diseases. Remittent or intermittent fever is the type more frequently met with, however, and under such conditions more food can be given. During the febrile period liquid or semi-solid foods are best, but during the intermission or remission solid food should be given. Thus in cases in which the temperature rises at noon, a substantial breakfast should be taken; while in those in which the fever comes on in the evening, both breakfast and dinner may be solid meals.

The most difficult condition to cope with, from a dietetic standpoint, is loss of appetite, which may be so great as to amount to repulsion for food. Many tuberculous patients through delicacy refrain from expectoration and swallow the sputum. This neutralizes to some extent the acidity of the gastric juice and coats the particles of food in the stomach, preventing proper contact with the digestive fluids, which leads to gastritis and loss of appetite. In other cases the gastric secretions may be normal, and appetite lost through a nervous fear of food. Lack of variety is another frequent cause of anorexia. Insufficient care of the mouth will frequently lead to disgust for food, as a coated tongue and teeth will produce a bad taste and prevent perception of the pleasant flavors of food.

These various conditions must be overcome by appropriate measures. If gastritis is present, lavage and a suitable diet must be instituted. If nervousness prevents the taking of the proper amount of food, a graduated diet increased daily in amount and strength may overcome the trouble, or a plain talk with the patient, explaining the inevitably dire results of abstinence, may induce co-operation. Failing in these, forced feeding with the stomach tube must be resorted to.

Not only must the quality and form of the foods be varied at different meals, but it is of equal importance that the patient should not know the menu for the day or direct the selection of the diet. Of course, where special dishes are desired, the patient's wishes should be gratified if the article is allowable.

As in the management of typhoid cases, the mouth toilet should be strictly attended to, the tongue and buccal surfaces being scraped with a loop of whalebone and the mouth washed with some antiseptic solution several times a day. Especially should this rinsing be done after taking milk.

Special Articles of Diet. PROTEIDS.—*Milk* is of much service in most cases, as it is a complete food and contains valuable fat. Conditions develop in the course of tuberculosis which may require an absolute milk diet. In these instances six to eight pints are given daily; but it is not well to continue such an amount for more than a few days, since the great bulk of fluid tends to develop atony of the stomach. By increasing blood pressure it adds to the work of the heart, which is apt to be weak under circumstances requiring so strict a diet. One to two quarts daily are of advantage and are sufficient when

other foods are given. Many persons object to milk through whim. This can often be overcome by judiciously altering the taste of the milk, but if the objection is founded on actual disagreement with the patient, it would be a mistake to force milk upon him. If the stomach is weak, milk must be rendered digestible by dilution or by the addition of lime-water or a little sodium bicarbonate (six grains) and table salt (five grains) to each glass. It should be remembered that milk frequently disagrees and proves indigestible because it is taken too rapidly, which induces the formation of large curds. It should, therefore, be swallowed slowly and its digestibility may often be improved if it is administered in small amounts at frequent intervals, say two ounces every fifteen minutes. It may be taken hot or cold according to the patient's preference, but it is best not to boil it, as this retards its digestion. In some cases it is necessary to predigest it. Repulsion may be forestalled by varying the milk diet with milk derivatives, such as buttermilk, koumiss, and whey.

Whey and *koumiss* have been extensively used as special "cures," the former in Germany and Switzerland, the latter originally in Southern Russia, where mares' milk from animals allowed to run at large is used for its preparation. Whey is apparently of advantage to individuals who can use it, but with many persons it can be taken only for a short time without the development of diarrhea. Lasting improvement has been observed resulting from the koumiss cure in persons who have taken it in Southern Russia, but how much the improvement was due to the pure air of the Caspian region and how much to the koumiss is indeterminable. The use of koumiss as prepared in America from cows' milk has no special advantage

over plain milk beyond its more ready digestibility, and many persons have great aversion to it.

Eggs.—Extensive use is made of eggs in the dietaries for tuberculosis. They are a complete food, rich in fat, and by most persons readily digested. They are best given raw and may be taken whole or beaten up with fresh milk. This mixture may be flavored with salt, or, when no contraindication exists, with sugar or other flavoring material. Raw eggs may be given with meals or between meals, and as many as a dozen a day are often used.

Meat Preparations.—Beef tea and *meat extracts,* though containing but a small amount of nutriment, are useful stimulants to the stomach and nervous system.

Meat powder, which contains much nutriment and is readily digested, is of real service. Yeo publishes the following instructions given by Dujardin-Beaumetz for making this powder: "Take the lean of beef, cut it up into small pieces, dry it in a water bath. When thoroughly dry, reduce it to a powder in a coffee mill;" or it may be rubbed up in a mortar. It has a pleasant odor and is practically tasteless. It may be mixed with soup, or added to milk in the proportion of from half an ounce to an ounce and a half of meat powder to a pint of milk.

Expressed beef juice, made by heating thick steak quickly, chopping and squeezing in a meat press, is a nutritious and valuable preparation, but it cannot be heated without coagulating the albumin. The best way to make it palatably warm is to place a cup of the juice in a vessel of hot water.

Tropon, which contains 90 per cent. of albumin, is also a good preparation to add to milk, soups, and broths.

When the acid of the gastric juice is too scant to digest unaltered proteid, digested preparations such as *peptones* and *somatose* are useful. The latter contains 80 per cent. of proteid and no extractives, and so does not stimulate nervous action.

Raw meat has been highly extolled as a nutrient in this disease. While its use has ardent advocates and it has done good service in certain cases, it is not generally considered to have special advantages. The drinking of fresh blood warm from butchering, which was at one time in vogue, has no merit and was simply a sensational procedure.

Gelatin is very useful in moderate amounts as an albumin sparer, and in the various forms in which it is prepared it makes a pleasant variety in the diet.

FATS.—This class of foods is of great importance in the dietetics of tuberculosis as an albumin sparer, since it conserves the body albumin and increases the patient's weight. It is also useful for heat production. From long observation of the action of fats in tuberculosis, Russell determined that in continued use of the same fat efficiency diminished, while improvement occurred when a change was made in the kind of fat administered. This led to his experiments with mixed fats, which in his hands have proved the most efficacious way of administering.

Cream is an easily digested fat for most persons. It may be added to milk or taken as pure cream. If it is not well tolerated in its natural state, its digestibility may be increased by the addition of hot water and a little aromatic spirit of ammonia. If the ammonia is not pleasant to the patient, brandy or some other alcoholic preparation may be used for flavoring. A little Chartreuse

added to a glass of cream, with some effervescent water, makes a very palatable drink.

Butter is one of the most readily digested fats and should be used freely with bread and other carbohydrate foods.

Cod-liver oil has long been popular in the treatment of this disease. Its odor and taste are unpleasant to many, but some persons, especially children, develop a liking for it. It is one of the most readily digested and easily absorbed fats on account of the bile salts which it contains. See suggests that the special benefit derived from its use is due to the fact that the utilization of oxygen for its combustion robs the bacilli of that substance which is necessary for their active proliferation. Cod-liver oil often produces indigestion because it is taken immediately after meals. When thus taken, it is liable to coat the particles of food and interfere with gastric digestion. It should be administered an hour and a half or two hours after meals, when the food has begun to pass from the stomach. In this way it is more promptly carried into the intestine, where it is digested. Pure oils are better than emulsions. They should be given at first in teaspoonful doses, or less, and the dose gradually increased to a tablespoonful as tolerance is established.

Olive oil is a useful and palatable form of fat, well digested by most persons, though, as a rule, the animal fats are better than those derived from vegetable sources. In cases with good gastric digestion it may be agreeably administered with egg-yolk in the form of Mayonnaise dressing with salads.

Cocoa and *chocolate* are useful for the fat which they contain and add to the variety of the diet. Chocolate is the better borne of the two.

Carbohydrates.—As in health, these substances should form a proper proportion of the dietary. *Whole wheat* and *brown breads* are considered of special value on account of the large percentage of phosphates which they contain. Meals made from peas, beans, and lentils are also rich in phosphates as well as proteids, and are useful administered in the form of purées. Oatmeal and cornmeal are especially suited to tuberculous cases on account of their richness in fats.

Malt extract is extensively used, especially in connection with farinaceous foods, on account of its diastase, which aids in the digestion of this class of foods.

Honey is a useful carbohydrate; one dessertspoonful is about equivalent in heat units to one egg. It is well digested by most persons and prevents constipation. Its pleasant flavor will induce patients to take more food. It is a good article for lunch with bread.

Grapes are a good food on account of their sugar, and in France and Germany the "grape cure" has been popular. It is suitable only in afebrile cases. Only large, juicy, ripe grapes are selected; their seeds and skin are removed. One and two pounds are given daily, half before breakfast, one-fourth before dinner, and one-fourth before supper. A larger amount is liable to induce diarrhea. Grapes should be combined with a richly nitrogenous diet.

Vegetable Juices.—Russell's more recent investigations in the dietetics of tuberculosis seem to show special advantage from the use of vegetable juices. Though his observations have covered too short a period to justify positive conclusions, his results would indicate that there is real merit in this administration. The beneficial effect

he attributes to some such action as the vegetable juices produce in scurvy. He has noted increased digestion of other foods by the use of vegetable juice. His method of preparation is as follows:

"Equal parts by weight of raw vegetables, after thorough washing by scrubbing with a brush and rinsing in fresh water (the skins are not removed), are mixed together and chopped in a chopping bowl until the particles are small enough to go easily into the receiver of the grinding machine, where the mass is reduced to pulp. The pulp is collected as it falls from the machine and the juice squeezed out through coarse muslin cloth. . . . . The vegetables first used were potato, onion, beet, turnip, cabbage, celery. Later sweet potato, apple, pineapple, carrot, parsnip, and later rhubarb (pie plant), summer squash, tomato, spinach, string beans, radishes, green peas with the pods were added. . . . . The juice is prepared every day and kept on ice."

Beverages.—Much difference of opinion as to the use of various beverages is shown in the directions given for their use. Some physicians allow *tea, coffee, cocoa,* and *chocolate* according to the patient's wishes, and recommend their use for covering the taste of milk, in order to induce a larger consumption of that food. Others, as a matter of routine, forbid these beverages. It would seem judicious to permit them unless some positive contraindication to their use exists, such as nervousness, insomnia, or constipation, for persons accustomed to any of them will not relish their food if deprived of them, and hence will eat less.

The use of alcohol is a matter about which physicians differ widely. It used to be given in very large amounts

under the belief that it was a food of special value, and some patients seemed to improve under it; but the general tendency in the use of alcohol to-day is to limit it to definite purposes.

When given before meals it does, in many persons, improve the appetite and stimulate gastric secretion, but in others it lessens appetite and retards digestion. It lowers temperature somewhat by increasing the cutaneous circulation, and through this same action it often lessens night-sweats and insomnia. These effects are beneficial and constitute the indications for its use. The too liberal use of alcohol will produce the same harmful results in tuberculous patients that it does in healthy persons.

Special care should be given to the selection of pure preparations, light red and white wines, good whiskey and brandy being the best to use. Cheap clarets and heavy wines like port and sherry are prone to disturb digestion and produce headache and should be sedulously avoided. Good beer, porter, or ale is permissible when it is preferred by the patient, especially in warm weather, and it is often more efficient than wines or spirits in stimulating the appetite. It is useful also, given at bed-time, for preventing sleeplessness.

In gastritis alcohol must be abandoned, and should be suspended when the patient develops aversion for it, and also in case of hemorrhage. Nor must it be forgotten that there is danger of habit formation by its continued free administration.

Forced Feeding.—The original method of forced feeding, as practised by Débove, was the introduction of large amounts of food into the stomach through a tube. He observed in certain cases, in which all food taken in the

usual way was vomited, that even large quantities would be retained when introduced through the tube, and that by this practice appetite was regained and nutrition re-established so that weight increased, night-sweats disappeared, and cough was diminished. He used for this feeding, four to ten eggs, six or seven ounces of meat powder, and two quarts of milk, introduced after washing the stomach.

It is not uncommon in tuberculosis for appetite to be lost without accompanying loss of digestive power, and under such conditions, especially when there is aversion to food in nervous patients, this method of forced feeding is advantageous; but there is a limit to the possibilities of every stomach, and care must be exercised not to overtax its powers and thus bring about a serious complication.

Débove's method is, to most persons, so repulsive that it has been largely superseded by others when food can be retained. The Weir Mitchell method depends upon the isolation of the patient, with rest of body and mind, and an absolute milk diet for several days, after which the diet is gradually increased. Three ounces of milk are given every two hours, and are taken very slowly, amounting to three or four quarts daily. Massage and electricity are used daily until exercise is permitted. By this form of treatment aversion to food is overcome and appetite established. Modifications of this method are frequently practised with benefit.

CHAPTER XV.

FOOD IN DISEASES OF THE DIGESTIVE TRACT. ACUTE GASTRITIS. CHRONIC GASTRITIS. DILATATION OF THE STOMACH. ULCER OF THE STOMACH. CANCER OF THE STOMACH. DIARRHEA. CONSTIPATION. CIRRHOSIS OF LIVER.

In a preceding chapter, in which nutrition in acute febrile conditions was considered, we had to determine the maintenance of strength and body tissues under conditions in which the organs of digestion were secondarily affected by constitutional diseases. In this chapter we have to consider nutrition in conditions in which the general constitution is secondarily affected by primary disturbances in the functions of the digestive organs. In the general febrile conditions disturbance of metabolism is the dominant consideration, the body tissues being unable to appropriate the food brought to them by the circulation after digestion, but in diseases of the digestive tract the dominant consideration is the digestion of foods which are readily appropriated thereafter by the tissues. In other words, we are hampered in the question of nutrition by disability of the organs first involved in the complicated process.

When an organ is crippled there are two methods by which its function may be restored—rest or exercise. By rest the demand for functional activity is withheld until the natural recuperative power of the body has restored the function. By exercise the function is gradually developed by additional demands upon it, increasing

little by little. According to the character of the disease the choice of methods is determined.

It must be borne in mind, as was stated in an earlier chapter, that no absolute rules of diet can be laid down which will cover every individual case, because of the peculiarities shown by some persons in failing to digest certain articles of food digestible by others, or in developing in the course of digestion by-products which produce illness.

Many diseases of the digestive organs are due to overfeeding or to eating improper foods. These are, of course, relieved when the error in judgment as to quantity or quality is corrected. Disturbances of digestion are also frequently due to the manner and time of eating. Too rapid eating, by causing the entrance of food in the stomach before it has been properly divided by chewing, will lead to disturbance, and indigestion is often caused by active mental or physical work too soon after a heavy meal through withdrawal of the blood thereby from the digestive organs at a time when active circulation is essential for proper digestion.

Diseases of the digestive organs are organic or functional. In organic diseases the structure of the organ is affected by a morbid process which interferes with the normal function. In the functional diseases organic changes are wanting, but the organ fails to perform its work. In either of these conditions the problem that confronts us is to supply the body with sufficient nutriment by the use of these disabled organs of digestion. It should be remembered that patients suffering from these diseases need as many heat units from their food as they would in health, and it has been shown that the

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emaciation in certain of these diseases is due not to poisonous substances developed, which prevent appropriation of food, but to a deficiency in the food provided after digestion; in other words, starvation. In organic diseases treatment by rest is indicated. In certain severe conditions this indication is met by rectal feeding in which absolute rest is obtained for the stomach and small intestines. In conditions of less severity a degree of rest may be obtained by varying the quality and quantity of food and the frequency of its administration. In functional diseases in which the digestive apparatus is intact, but showing diminished activity, the treatment is in general by exercise, beginning often with liquid or semisolid foods and gradually adding foods more difficult of digestion, thus toning up the organ to normal function.

In selecting the articles of food for any given case the diet should comprise, except in certain special instances, all of the alimentary substances, proteids, carbohydrates, fats, salts, and water, the difference from normal diet being in the method and form of administration. A common error in feeding in diseases of the digestive tract is the omission of fat from the diet. Good butter is readily digestible and is a concentrated food which supplies calories of heat generously, and the occasions for withholding fat in this form are rare in these diseases.

Acute Gastritis.—In this condition there is an acute inflammation of the mucous membrane of the stomach with a decrease in the amount of gastric juice and diminution of its strength. Contact of any violent irritant with the gastric mucous membrane, such as strong acids, will produce it, but it is commonly met with as an accompaniment of certain febrile diseases and most often as the result of improper diet. Overloading the stomach

with food leads to abnormal fermentation, as the supply of gastric juice is not sufficient to digest the excessive amount of food. This is a common cause of acute catarrh, and especially in weak persons who attempt by over-feeding to rapidly increase their lost strength. Too rapid eating, through improper mastication, leads to this condition. When the food enters the stomach in too large pieces, only the surface is digested and the interior portion is liable to undergo fermentation. Overripe game and fish by introducing germs of decomposition are a frequent cause. Highly seasoned foods and rich gravies, by irritating the mucous membrane and coating the food with a layer of grease impermeable to the gastric juice, invite fermentation and acute catarrh.

In this condition vomiting is present and the appetite usually lost. Under these circumstances it is useless to force food upon the patient, for it will not be digested if retained, and will by its presence increase the irritation already present. The treatment is rest. Withholding food absolutely will do no harm if the patient is robust, as the attack is usually of short duration. When the catarrh is of severe grade and the patient is feeble and in need of continued nourishment, rectal enemata should be administered. As the inflammation abates, and in mild cases from the beginning, food may be administered by mouth, being given in small quantities and at frequent intervals. Milk is a good food to use, but it should be diluted, either with lime-water or barley-water, to prevent the formation of large curds. Egg may be used, but should be given raw, either as egg albumin diluted with water, or the whole egg may be given mixed with hot water. Whey is a good substitute for milk. In some cases predigested food, such as peptonoids, are required.

Farinaceous foods, such as Mellin's, or Robinson's Barley, may be added to the milk as the patient improves. Meat juices are very useful in this disease and one of the best of them is Valentine's.

Thirst is marked and is often intense. Sucking bits of ice will often relieve, but, if this fails, cool water taken in sips should be allowed. If vomiting is so intense as to preclude the drinking of water, it must be administered by rectum, or, if necessary, by hypodermoclysis.

In the beginning of mouth feeding very small quantities are to be used, one or two tablespoonfuls of diluted milk being given every hour or two hours.

When convalescence begins, soft-boiled rice, squab, scraped beef, chicken, soft-cooked eggs, and baked potatoes may be gradually added to the diet. Great care must be taken that these foods be given in small amounts, as the gastric function is below par after an acute attack of gastritis, and overloading the stomach will certainly cause a return of acute symptoms. Tea and coffee should be withheld during the attack, but may be given in convalescence, tea being better borne, as a rule. Alcohol should be forbidden, as it tends to increase the irritation and thus aggravate the symptoms.

Chronic Gastritis.—This condition often develops as a sequel of acute gastritis, or it may come on insidiously. Excess in the quantity of food taken often leads to it, especially if the food is highly seasoned or if sauces and rich gravies are freely used. Such foods are particularly liable to bring on the condition if partaken of when mentally depressed or worried, as under such conditions the gastric juice is usually less abundant than normal and the digestion is proportionately impaired. Alcohol is a

frequent cause of the disease. The constant irritation produced by its habitual use causes changes in the walls of the bloodvessels and affects circulation, which renders the muscular action of the stomach sluggish. The result of this is retarded digestion leading to fermentation, with the development of irritant acids which produce a catarrhal inflammation. The condition is also caused by diseases which interfere indirectly with the circulation in the stomach by obstructing the portal circulation, such as certain diseases of the liver, heart, and lungs, and by long-continued diseases associated with anemia and neurasthenia.

The walls of the stomach may be much thickened and the mucous membrane corrugated and thrown into large folds, or the walls may become thin and the mucous membrane stretched and attenuated. In severe cases the glands may atrophy completely. The important consideration is the degree to which hydrochloric acid secretion occurs. This may be normal in amount, increased or diminished, and if atrophy of the glands has occurred it may be entirely absent. Accompanying any of these conditions there may be an excessive secretion of mucus. When this occurs, it further increases the difficulty of gastric digestion by coating the particles of food, thereby preventing contact with the gastric juice. Appetite may be diminished or lost or it may be much greater than normal.

These conditions lead to slow digestion, and the irritant gases developed by fermentation produce eructations, and regurgitation of the acids causes the uncomfortable sensation of "heartburn."

Dietetic treatment should include careful directions as

to the manner of taking food as well as deciding the articles of the diet. Thorough mastication is essential, as the impaired stomach is not able to digest large masses. Deficiency in the chemical action in the stomach can be compensated for by active intestinal digestion, but mastication can be performed only in the mouth, and if imperfectly accomplished there, the fault cannot be remedied later. This necessitates eating slowly and if cheerfulness surrounds the board improvement will be more marked. Great care should be taken to keep the teeth in good condition. Meals should be regular and punctual and should be preceded and followed by half an hour of rest, lying down. The quantity of food should be strictly limited. Enough must be taken to maintain nutrition, but no excess beyond this should be allowed. It is well for the patient to end the meal always before full satiety. It is often advantageous to allow the patient to select articles which experience has taught to be well borne in his case. Nothing should be permitted between meals and the intervals between them ought to be long.

In severe cases milk is indicated, but the formation of large curds must be prevented by dilution with lime-water, Vichy or soda water. A little salt added increases its digestibility. If undigested curd appears in the stools, even when the milk is diluted or boiled, it must be diminished in amount or predigested. In many cases it must be discontinued. A glassful—about 6 ounces—can usually be given every two and a half or three hours. Buttermilk is often digestible when milk is not. Fresh meat juice, egg albumin, or scraped beef may be substituted when desired.

In milder cases minced meats, beef, mutton, or chicken,

with dry toast or stale bread and a small quantity of butter, may be given. To these may be added, as the condition improves, boiled rice, baked potatoes, shredded wheat, toasted crackers, zweiback, chopped spinach, baked apples, orange juice, baked custard, and plain blanc mange. Caution must be used in administering farinaceous foods on account of their readiness to ferment. They should be given in small quantity and their effects carefully watched. Smoked and salted meats are sometimes more easily digested than fresh, as they do not decompose so readily during the protracted period of stomach digestion. Raw and stewed oysters are usually well digested and soft-cooked eggs are allowable, but if intestinal irritation accompanies the gastritis, whole eggs must be given guardedly, as the yolk readily decomposes in the intestine if its function is at all impaired.

Water should be given in moderation at meals. A glass of cool water, or, better, a glass of some hot alkaline water such as Vichy, may be taken with advantage half an hour before meals, as it will help to loosen and remove the tenacious mucus which clings to the lining membrane of the stomach. This will free the glandular ducts, which the mucus often occludes, and will thereby increase the hydrochloric acid.

Water should not be taken for several hours after food, but should be drunk freely between meals and at bedtime. The permissibility of tea or coffee is not settled, some physicians permitting one and forbidding the other. If allowed, tea should be weak and coffee will interfere less with digestion if taken black, without sugar or cream.

The following articles should be rigidly excluded from the diet: Things fried, twice-cooked meats, coarse vege-

tables, sweets, pastries, cakes, puddings, acids, spices, condiments, alcohol, hard-cooked eggs, fat meats, shell-fish, except oysters, and all substances known to disagree with the individual.

Mucous Gastritis.—In those cases in which mucus is excessively secreted, gastric lavage must be performed once daily, either at bed-time or before breakfast, in order to remove this mechanical hindrance to digestion. The diet should be as described above.

Hyperchlorhydria.—An abnormally increased secretion of hydrochloric acid frequently accompanies chronic gastritis or may be caused independently by etiological conditions identical with those producing that disease, such as hasty eating, overeating, worry, nervous shock, fatigue, ulcer, alcohol, and tobacco.

The diet should be selected to minimize the irritation of the secretory and sensory nerve terminals of the stomach, whether produced mechanically, chemically, or thermally. In other words, food should be finely divided, non-irritating, and neither too hot nor too cold. While all agree that patients suffering from this trouble must have a mixed diet, there is difference of opinion as to the details. Some physicians give only carbohydrates and milk, on the ground that meats stimulate the flow of hydrochloric acid, while others prescribe a preponderance of meats to combine with the excess of acid present. Though noted clinicians advocate each view, the latter is the more popular teaching. Finely minced meat or meat pulp, eggs, fish, oysters, and milk supply a non-irritating diet which readily combines with the acid. Fats in the form of butter and cream are well borne and tend to reduce the quantity of acid secreted. With the meats

may be given a small amount of toast or zweiback and green vegetables finely divided and made into purées. As improvement advances, stale bread, rice, vegetable purées, and well-cooked oatmeal may be added, and finally the usual diet may be resumed.

Opinion differs also with regard to the frequency of meals, some giving two large ones a day in order to rest the stomach, while others advocate frequent small meals at short intervals, giving five or six a day. When milk is used as the chief proteid food the latter plan is the better. Gavage is recommended when the patient loses weight and appetite, as the psychic gastric juice is thereby prevented, the odor and taste of food being excluded.

Beverages should be limited, and alkaline waters, such as Vichy, are the best to use. Certain articles should be excluded from the diet as listed for chronic gastritis.

Hypochlorhydria.—A diminution of the hydrochloric acid follows a period of hyperchlorhydria. As in that condition, opposite views are held, meat preparations being given on the one hand because they stimulate gastric secretion, and carbohydrates used on the other hand because the diminished amount of the acid is insufficient for proteid digestion. It is agreed, however, that small quantities of food should be given and at sufficiently long intervals to permit of complete digestion by the weakened gastric juice. Condiments are used to stimulate gastric secretion.

If a preponderating meat diet is determined upon, the articles listed in the preceding section will meet the requirements, but if carbohydrates are to be chiefly given, vegetable purèes and any of the farinaceous foods, such as rice, tapioca, farina, Mellin's Food or Robinson's Barley,

may be used, and the necessary proteid supplied by bread, peas, milk, and oysters or fish.

If fermentation is excessive, preference must be given to the meat diet, as it should if carbohydrate diet produces irritation of the intestine and diarrhea. Otherwise the carbohydrate diet may be satisfactory. In either case intestinal digestion will complement gastric deficiency. Bulky foods should be avoided and fine division is essential.

Achlorhydria.—Entire absence of hydrochloric acid renders the stomach a mechanical food receptacle rather than an organ of digestion, and this lack of function must be supplemented by the intestine. In selecting the diet, such articles must be chosen as can be readily passed from the stomach into the intestine and can be there easily digested. Liquid or pulverized foods are the best: milk, cereals cooked to mush, expressed meat juice, meat pulp, vegetable soups strained, fresh peas and spinach thoroughly cooked and run through a colander, and liquid carbohydrate foods. A little toast may be allowed if it is thoroughly chewed. Butter, cream, and crisp breakfast bacon will best supply the necessary fats. Water should be given, and weak tea, coffee, or cocoa are allowable in some cases. From such a list sufficient variety can be arranged.

Dilatation of the Stomach.—This name is not applied to an enlarged stomach which retains its normal function, but indicates a pathological condition in which the muscle walls of the organ have to a greater or less degree lost their tone so that the contractile power is diminished. Food is, therefore, retained longer than normally in the stomach and undergoes fermentation, developing irritant acids which produce a catarrhal inflammation.

The condition may arise mechanically from obstruction of the pylorus, preventing the escape of the stomach contents into the intestine, as in cancer or cicatrices from any cause; or it may follow from constitutional affections like neurasthenia and anemia by progressive weakening of the muscle tissues from lack of proper nutrition. Habitual excess in eating and drinking will often cause the condition.

Whatever the cause, the developed state presents two main pathological considerations, exhaustion of the gastric muscle and bacterial growth in the gastric cavity. From these the general principles of dietetic treatment are evident, to avoid further distention of the organ by food in too great bulk, which is best accomplished by the use of concentrated foods in small amount at infrequent intervals, and to prevent fermentation by proper cleansing of the stomach and avoidance of foods specially liable to decomposition.

Fluids must be sparingly used, as they are heavy and their weight tends to increase the stretching of the weakened muscles. Water should be strictly limited. Not more than six or eight ounces should be permitted with meals, as it will dilute the gastric juice and, when taken with meals, is itself slowly absorbed and lessens the absorption of food in a disabled stomach. Between meals and before meals—that is, four hours after a meal and until half an hour before the next—water in small amount is allowable, as it is then more promptly absorbed from the stomach and passes more readily into the intestine. It is an advantage to give a teacup of hot water half an hour before meals, as this lessens thirst at meals and helps to carry remains of the previous one out of the stomach

into the intestines. Water should never be drunk in gulps, but sipped slowly, and when given with meals it should not be taken while food is in the mouth, as there is danger of washing into the stomach pieces of food which have not been thoroughly masticated.

Animal foods must form the chief part of the diet, as they are the more concentrated. When digestion is sufficiently active, only solid food should be given, but this should be minced fine and thoroughly chewed. A small amount of carbohydrates and fresh vegetables must be given in cases of moderate severity. Articles which best meet the requirements are scraped or minced beef, minced fish, boiled fish, soft-cooked and raw eggs, stale bread, toast or zweiback, rice, peas, spinach, lettuce, asparagus, and tomatoes. The green vegetables, like the meats, must be finely divided and are best given in purées. Thin soups are not allowable. Sugars and fats are prohibited.

It was formerly the usual custom in the treatment of gastric dilatation to give small meals at frequent intervals, but this has now been abandoned.

The normal digestive cycle consists of (1) the ingestion of food, (2) its digestion and expulsion, and (3) the interval of rest. By the frequent administration of small meals, the period of rest is encroached upon and the gastric muscle kept in a state of constant activity, thus allowing no time for the muscle to recuperate and regain its tone, and the constant presence of food in the stomach furnishes an excellent medium for the multiplication of bacteria. By using larger meals at longer intervals, the labor period is relatively shortened and the interval of rest is prolonged, as the increased bulk excites the motor activity of the stomach, producing more rapid expulsion of its contents.

The interval between meals should be from six to eight hours.

In severe cases, especially when vomiting is a marked feature, it is often necessary to have recourse to rectal feeding in order to give complete rest to the stomach, and when giving food by mouth, it may be necessary to lessen the total amount and undernourish the patient for a while. When return is made to mouth feeding after a period of rectal feeding, small quantities of milk may be given—say, one or two tablespoonfuls every hour or two—the food being gradually increased in strength and the intervals lengthened; or solid food may be given at once, beginning with a small meal once a day, increasing the quantity and the number of feedings as recovery progresses.

Recumbency on the right side for two hours after each meal aids expulsion of the stomach contents.

In weak, jaded patients with complete anorexia and apparently no digestive energy, gavage yields excellent results, the exercise of the stomach bringing about a restoration of the digestive functions, and the patient begins to take food independently and with relish.

When the appetite is excessive a cracker and a little hot water just before meals will prevent unnatural appetite.

Gastric lavage is an important adjunct to the treatment of dilatation, as it is an efficient means of cleansing the stomach and removing the stagnating remains of food. It is, however, a practice often much abused, and for cases of moderate dilatation it is usually not necessary, dietetic treatment alone being often sufficient to cure.

Gastric Ulcer.—In this disease, in which the mucous membrane of the stomach is denuded and ulcerated, the

problem is to maintain nutrition by such means as will permit of healing even while the stomach is called upon to perform its functions. Such foods must be selected, therefore, as will not mechanically injure the raw surface and produce hemorrhage, and since excessive acid is a factor in the production of ulcer, foods which stimulate the acid secretion should be avoided. Great care must be observed to avoid distention by the use of excessive amounts of food or such food as would readily ferment and produce gas, as this would stretch the ulcerated surface and prevent clot formation and healing. The stomach must be kept at rest as far as possible, since any violent peristaltic movement would dislodge clots already formed, preventing healing and possibly causing hemorrhage.

While it is allowable in mild cases without hemorrhage to feed by mouth from the beginning of treatment, the presence of hemorrhage is often the symptom on account of which the patient presents himself for treatment. When this exists, complete rest must be secured for the organ by the use of nutrient enemata and the absolute withdrawal of mouth feeding for a period of from three days to one week, according to the severity of the hemorrhage. When mouth feeding is instituted, milk best meets the indications. On account of the hyperacidity usually present and in order to prevent the formation of large curds, the milk must be well diluted with lime-water, equal parts, or in combination with barley, oatmeal, or rice-water. At first this should be administered in tablespoonful doses every hour or half-hour and rectal feeding continued at longer intervals than before. If this is well borne, the amount can be rapidly increased to half a glass every two hours. This should be continued for at least

three weeks in mild cases, and much longer in severe cases, after which the diet may be strengthened gradually by the addition of egg albumin, egg and milk, scraped beef, raw oysters, and farinaceous foods, such as tapioca, sago, and rice.

When the patient is on strict milk diet, it should be eaten and not gulped down in quantity—that is, it should be taken a teaspoonful at a time and swallowed slowly—and like caution must be observed when solid food is first allowed, great care being taken to thoroughly chew the food, which should be limited to but a few mouthfuls.

If milk is administered as prescribed above, most patients will be able to take it without difficulty, even those who in health could not digest plain milk; but if the aversion to milk is so great or its digestion so poor that its use cannot be continued, other derivatives, such as buttermilk, koumiss, or whey, may be used; and when these cannot be taken, meat juices, such as Wyeth's or Valentine's, or expressed meat juice made at home, must be substituted. Many persons who cannot digest plain milk can eat ice-cream, which is a useful article for variety and may even constitute the sole diet for a day or two at a time.

Water is usually well borne and is beneficial, especially when given hot. After convalescence the patient should be kept for several months on a mixed, non-irritating diet, avoiding acid fruits, alcoholic drinks, sweets and condiments, rich foods, coarse fruits and vegetables, especially those which contain numerous small seeds. Upon the slightest evidence of return of the trouble, restricted or milk diet should be at once instituted.

Cancer of Stomach.—To relieve the patient and to prolong life in this disease, the dietetic problem is to

maintain sufficient nutrition to check the progressive emaciation, and at the same time to impose upon the disabled stomach a minimum of work. No fixed rules can be given, as the diet must be determined for each case and must vary according to the site and extent of the tumor.

If the cancer is situated at the cardiac end of the stomach, progressive constriction will soon proscribe the use of solid foods, for they will not pass into the stomach and will produce dilatation of the œsophagus.

When the pylorus is involved, care must be taken not to give foods that will be long retained in the stomach or that will readily undergo abnormal fermentation with the development of acid, since this will irritate the stomach and materially increase the pain. Such fermentation, further, tends to hasten dilatation of the organ—a condition which greatly complicates the difficulties of dietetic treatment.

Many cases of cancer of the stomach retain considerable digestive power, but in nearly all cases there is a diminution of the hydrochloric acid and in some an entire absence of it.

Because of this deficiency of acid, the power of the stomach to digest proteids is lessened, and this class of foods should on that account be limited. Practical experience has demonstrated, however, that the carbohydrates are prone to ferment, increasing pain and interfering greatly with digestion, while the proteids which are not digested in the stomach pass on into the intestine, where the digestion is completed.

So long as the pylorus is open, a readily digestible mixed diet may be given; but when the constriction has advanced

to such an extent that the emptying of the stomach is materially retarded, the diet should be restricted to foods that are digested and absorbed in the stomach.

In most cases of cancer of the stomach liquid food is desirable, but in all cases the bulk should be small; and if solid food is permitted, it should be finely divided in order to facilitate digestion and to avoid the irritation which food in bulk would produce, with the resultant vomiting so easily excited. As hydrochloric acid diminishes, it may often be necessary to predigest the food. Should serious hemorrhages occur, rectal feeding must be instituted in order to avoid irritation of the stomach while extensive abrasions are present. This may also be practised to abet insufficient mouth feeding.

Milk well meets the dietetic indication, but it should be diluted with lime-water or partially predigested to prevent the formation of tough curds. Buttermilk is an excellent substitute, for the casein, already coagulated, is finely divided. Soups, meat extracts, finely minced tender lean meats, soft-cooked eggs, and stewed fruits are the best reliances. Indulgences in special cravings of the patient should be granted as far as practicable.

Water should be given in small quantities or by rectal injection. It may be given hot with advantage half an hour before meals. Whiskey and water may be given, or diluted red wine. Sweet wines, beer, coarse vegetables, and fruits should be prohibited.

When complete obstruction of the pylorus occurs, only predigested foods can be given and the remains must be removed once a day by gastric lavage. This must be done very cautiously always and temporarily abandoned after recent hemorrhage to avoid renewal of hemorrhage or

perforation. When the pylorus is obstructed, rectal feeding will often be necessary as the only method of nourishing or to supplement the scant mouth feeding which is possible under the circumstances.

When the cardia is the seat of the tumor, the objection to farinaceous foods that obtains in pyloric involvement does not hold, as they can be passed on to the intestine for digestion if they once enter the stomach. They must, of course, be in liquid form. Mellin's Food, Robinson's Barley, and similar preparations meet the requirements.

Diarrhea.—Frequent thin stools may be a symptom of some serious disease of the intestines, or may be caused by mechanical or chemical irritation of the intestinal mucous membrane by food which leads to increased peristalsis or augments the secretions. Mechanical irritation is produced by undigested foods or by those which leave a large amount of residue, such as unripe fruits, green vegetables, etc. Chemical irritation is caused by toxic materials produced by fermentation of food, or by highly seasoned or spoiled foods, or by purgatives. Excessive drinking of water may cause diarrhea. This occurs especially in hot weather, when soda-water with fruit syrups is indulged in to excess.

An acute attack of diarrhea from any of such causes as the above may often be relieved by withholding all food for twenty-four hours, but water should be frequently given in small amounts in order to aid the emptying by the intestines of their irritant contents and to facilitate the elimination of the toxic materials by the kidneys.

Food in acute diarrhea must be easily digestible and absorbable and not liable to ready fermentation. It should be given in small amounts in order not to overload the

intestines at any one time. Relief is often delayed by overfeeding through the anxiety of friends. Milk is the best diet, when it can be taken. It should be diluted with lime-water or otherwise modified to avoid the formation of large curds which would act as mechanical irritants, and it should constitute the sole diet until all acute symptoms have disappeared. Six ounces every three hours will usually suffice, but in very severe cases it is better to give only an ounce or two every hour at first. When milk cannot be taken, egg-albumin water or meat broths must be substituted. These may be thickened with a little arrowroot or flour-ball. As convalescence is established, the diet may be cautiously increased by the addition of raw oysters, scraped beef, soft-boiled rice, stale bread, breast of chicken or quail, baked potatoes, etc. Alcoholics are usually avoided, but, if desirable, good French brandy is the best. Weak tea may be allowed.

If the attack has been mild, a return to the usual diet may be promptly made; but if it has been severe, the different articles must be cautiously added, and green vegetables, raw fruits, fats, acid foods, cheese, sweets, gravies, condiments, and tough meats must be avoided for some time.

Chronic diarrhea is a much more difficult condition to determine a diet for. In cases of long standing, the alkalinity of the intestinal secretions is reduced. This lessens the efficiency of the pancreatic juice, so that fats and starches are not well digested. No routine directions should be given, but the diet should be regulated in accordance with the individual's power of intestinal digestion. While fats should be withheld in some cases, many patients will digest well pure fats, such as good butter,

even in large amount, and their administration is desirable, when possible, as they materially lessen exhaustion.

The principles to be observed in selecting the diet are avoidance of substances which might increase the catarrh, and selection of such foods as can be digested by the individual, especially those that have astringent effect and tend to lessen secretions. The greater the number of stools, the more the diet must be restricted.

An absolute milk diet will in many cases conduce to cure; in others milk is not well borne, but will increase the number of stools. Milk is best given hot, as it is less apt to excite peristalsis than cold milk. It should be given in small amounts at frequent intervals. Egg albumin is very serviceable, but the use of whole eggs must be cautiously tried, since the yolk is liable to undergo fermentation. Meat preparations are apt to excite peristalsis and starchy foods ferment readily. In individual cases, however, either may be tolerated. Expressed beef juice, beef pulp, or Valentine's Meat Juice, may be tried, or gruels of barley, rice, or farina, which tend to lessen peristalsis by the mucin which they contain. Predigested foods may be necessary. If alcoholic beverages are required, clarets or brandy are best on account of their astringency.

When convalescence is established, minced meat (better raw), stale bread, milk toast, raw oysters, and purées of peas or potatoes may be guardedly added to the diet. Cold drinks of all kinds, especially carbonized beverages, fat meats, and vegetables containing much cellulose, such as cabbage, spinach, beets and other roots, must be avoided. Acids and sugars must be strictly prohibited, and saccharine used for sweetening.

Diarrhea in infants occurs chiefly in the bottle-fed children. It is due to bacterial action produced by the use of milk that has become polluted through carelessness before or after delivery at the residence. Careful investigation should be made by the physician to determine the source of contamination in order to correct it. Breast-fed infants may develop diarrhea by nursing dirty nipples which have not been properly cleansed before and after feeding. Food should be withheld for twenty-four hours or only a little albumin-water administered infrequently. Sterilized water should be given often. It is frequently best to withdraw milk entirely until convalescence is established and to depend upon albumin-water, expressed meat juice, or Valentine's Meat Juice, for nutriment. In many cases, however, especially the mild ones, milk may be continued if well diluted with lime-water or modified. If acid fermentation accompanies the diarrhea, as evidenced by the sour odor of the stools, the fat and sugar should be lessened, but if the odor is putrid the albumin should be reduced. Koumiss as the sole diet has given excellent results in many cases. In severe cases food should be given in small amounts. In severe infections like cholera infantum and in chronic diarrhea flushing the colon by rectal injections with normal salt solution is beneficial both for cleansing the bowel and for supplying water to the body to replace that lost by purging and vomiting, since some will be absorbed when thus administered.

Constipation.—This condition may be a symptom of a severe or dangerous disease, or it may occur as an independent malady. In the former case the dietetic treatment will be modified by the accompanying circum-

stances. Here may be considered only simple chronic constipation.

A variety of causes may lead to this disease, which is due to a diminution of peristalsis or deficiency of secretion, or both. It may arise from a loss of tone of the intestinal wall as the result of intestinal catarrh. Sedentary habits may lead to a similar condition and will lessen the peristalsis. Dietetic errors are among the most common causes. When the diet consists of an excessive proportion of readily absorbable foods, such as meat, milk, and eggs, which leave but little residue, the intestine is not sufficiently distended by the food to produce the normal stimulus to peristalsis, and constipation is apt to follow.

In some cases a diet which is too stimulating may often lead to this trouble by exhausting the excitability of the nerve terminals in the intestinal wall. In this way the abuse of purgatives causes the disorder. Deficiency of water in the diet may produce constipation, since this error diminishes the volume of blood and lessens the secretion of fluids by the intestinal glands. The use of astringent foods and beverages is often a causative factor.

As in other diseases, prophylaxis is better than cure, and many cases of chronic constipation could be avoided if parents would refrain from the use of purgatives with their children, and would inculcate in them regular habits with regard to their daily evacuations.

Several classes of foods are useful in dietetic treatment of constipation, and while individuals will find certain of them more efficacious than others, a judicious combination is perhaps the best plan, or else variation from day to day.

Since excess of animal foods has been mentioned as a cause of constipation, it might be supposed that the total

exclusion of this class from the diet would be advantageous. While true theoretically, this would be unwise practically, since the maintenance of nutrition would be more difficult on a strictly vegetable diet and such a plan of feeding would, furthermore, tend to produce flatulence and dilatation of the stomach and of the intestines. Hence, a mixed diet is the correct one, but it should contain a minimum of wholly digestible foods and a maximum of those which leave a large residue of undigestible material, in order that the bulk may act as a mechanical stimulant to peristalsis by distending the intestine.

Organic acids stimulate peristalsis, as do also various mineral salts. Sugars likewise have this action on the intestine. This effect may be brought about either by the development of organic acids through fermentation of the sugar, or by the abstraction of water from the lining membrane of the intestine, an action which the sugars have in common with the salts. Sugars are not equally laxative. Milk sugar, fruit sugar, and grape sugar are more efficacious than cane sugar. Buttermilk, sour milk, and koumiss are laxative by virtue of the organic acids which they contain.

Fruits are commonly used for laxative effect. This is due to their content of vegetable acids, sugars, and cellulose, and in some instances to their numerous small seeds. They are thus both chemically and mechanically stimulants to peristalsis. Though so well adapted by structure and composition for laxative effect, they are often ineffectual because they are injudiciously used. When taken with a meal, their effect is to a degree lost, as contact of their effective ingredients with the mucous membrane is largely prevented by the other food present.

For good laxative effect they should be taken on an empty stomach in the morning some time before breakfast, or at bed-time. Apples, pears, peaches, prunes, figs, dates, oranges, grape fruit, and the various berries which contain small seed, such as blackberries, are useful.

Water should be freely drunk; especially should a glass of cold water be taked early in the morning on rising. This not only increases the fluid of the blood, augmenting secretion, but by its thermic effect stimulates peristalsis. Hot water does not stimulate peristalsis as does cold. From six to ten glasses should be taken daily. In mild cases of constipation this morning draught and a little fruit will often be sufficient to give relief, while in others good results are obtained by eating a few figs or an apple and by drinking a glass of water on retiring.

The most laxative vegetables are tomatoes, spinach, lettuce, asparagus, onions, salsify, cabbage, and celery. Coarse cereals such as oatmeal, cornmeal, and others which contain the husk of the grain are useful laxative foods. Bread made of finely bolted flour is constipating because it is too completely absorbed, but Graham, rye, and whole wheat breads are preventives. The addition of bran to ordinary wheat flour in as large proportion as is consistent with good bread-making, is also a helpful measure. Sweets, such as honey, molasses, candy, or preserved fruits, are all useful if they can be digested by the individual, but in the use of these preparations it must be borne in mind that they will disturb digestion if they are used too concentrated.

Coffee stimulates peristalsis, but this effect will be materially lessened if cream is added. It is best to take coffee black, and, if served iced, it will have more effect

than if taken hot. Butter should be taken with all of the meals.

Astringent beverages, such as tea, red wines, and brandy, must be excluded.

Moderate cases of constipation may frequently be relieved by dietetic treatment, but cases of long standing cannot be cured unless there be associated with a rational diet other hygienic measures, such as proper habits, exercise, and sometimes massage, or electricity.

Many variations from the outline above must be made when constipation is associated with other abnormal conditions. Thus, in intestinal catarrh vegetables and fruits rich in cellulose must be avoided, and it would evidently be improper to give sugar in diabetes or in glycosuria.

Individuals show great variation in their susceptibility to dietetic effects, and the special classes of foods and even the individual articles of any class must be selected with intelligence for each case.

A good specimen dietary of Penzoldt published by Boas in his *Diseases of the Intestines* is as follows:

"7 A.M.—A glass of cold water.

"8 A.M.—A liberal breakfast, with sweetened coffee, a good deal of butter, honey, and Graham bread or pumpernickel, after which the patient should go to stool.

"1 P.M.—Midday meal of meat, a good deal of vegetables, salad, stewed fruits, farinaceous food, half a bottle of light wine (Moselle) or cider.

"7 P.M.—Meat, with a good deal of butter; Graham bread, stewed fruit, and beer.

"10 P.M.—Before retiring, fresh or stewed fruit."

Cirrhosis of the Liver.—Among the causes of this condition are habitual use of alcohol, strong spices, and highly

seasoned foods. These articles must, of course, be forbidden. An absolute milk diet is said to give the best results of any form of treatment. The usual difficulties attending the restriction of food to one article will be met with in the course of treatment, such as repulsion, indigestion, and loss of appetite. As in other diseases in which milk is the exclusive diet, the substitution of some of its derivatives and variation in the manner of serving will enable a patient to continue it longer. When milk cannot be taken alone, milk soups flavored with vegetables, such as celery, egg and milk mixtures and bouillon may be substituted. Tea and coffee are permissible in moderate amount, but sugars, starches, and fats should be excluded. Saccharin may be used for flavoring. As the patient improves, green vegetables may be given and a minimum of baked potato. Zwieback and toast are also permissible. When meats must be given, fish, oysters, and the breast of chicken, finely minced, are the best to use.

Much has been claimed for the "dry cure" as a treatment when ascites develops. This consists in withholding fluids and giving bread and meats chiefly. It has been helpful in some cases, but often fails.

CHAPTER XVI.

FOOD IN DISORDERS OF NUTRITION. OBESITY. GOUT. DIABETES. SCURVY. CHRONIC RHEUMATISM. RHEUMATOID ARTHRITIS.

Obesity.—Obesity is frequently caused by habitual excess in eating. Though it may occur in youth, it is usually a disease of middle life, and in these cases the continuance of the dietetic habits formed in youth is frequently responsible.

The body fat is derived chiefly from fats and carbohydrates, although proteids also contribute to its production. These differences in the source of fat have been the basis of numerous treatments, characterized by the special restriction of one kind of food, though all reduce the carbohydrates and the total quantity of food. The fact that many methods, varying essentially in their principles, have been successful in numerous instances, indicates that the faculty of producing fat from different kinds of foods varies with the individual. From this it will be evident that no routine diet can be established which will prove effectual in all cases.

The objects sought in all dietetic treatment are to bring about consumption of the patient's body fat by restricting the amount of food and to prevent its reaccumulation by regulating its quality. Though the discussion of the indications for reduction in obesity belongs to the subject of Practice of Medicine, caution must here be given against ill-advised efforts at reduction in weight; for many persons who, though obese, were healthy, have lost their

health irreparably by misguided efforts to reduce their flesh.

Reduction in the quantity of food is essential, and should be carried to the minimum compatible with the maintenance of health. Instead of the 2500 to 3000 calories allowed for normal persons, the fuel value of the food must be reduced to 2000 or less. Sugars must be absolutely excluded and starches greatly restricted, reliance for nutrition being placed chiefly upon proteids with the addition of sufficient green vegetables to make the necessary bulk to stimulate peristalsis. The reduction from the usual diet to the prescribed diet should be gradually brought about, since a sudden deprivation of the usual amount of food will produce great discomfort. The total daily amount allowed should be distributed throughout the day at short intervals, as this lessens the weakness which the patients usually complain of. Van Noorden's dietary (taken from Osler) is as follows:

"8 A.M., 80 grams of lean, cold meat; 25 grams of bread; one cup of tea, with a spoonful of milk, no sugar. 10 A.M., one egg. 12 M., a cup of strong meat broth. 1 P.M., a small plate of meat soup, flavored with vegetables; 159 grams of lean meat of one or two sorts, partly fish, partly flesh; 100 grams of potatoes with salad; 100 grams of fresh fruit, or compote without sugar. 3 P.M., a cup of black coffee. 4 P.M., 200 grams of fresh fruit. 6 P.M., a quarter of a litre of milk, if desired, with tea. 8 P.M., 125 grams of cold meat or 180 grams of meat weighed raw and grilled, and eaten with pickles or radishes and salad; 30 grams of Graham bread, and two or three spoonfuls of cooked fruit without sugar." (One ounce is equal to about 31 grams.)

Van Noorden permits the use of water according to the patient's desire.

Alcohol should be prohibited, since by its combustion it lessens the consumption of the body fat and its use increases the desire for food.

Great restriction in the quantity of water permitted has been recommended by some practitioners, but this would not be safe for persons having a tendency to uric acid retention.

The Banting method reduces the total amount of solid foods to from 21 to 27 ounces of solid food per day. Of this, animal foods compose 13 to 16 ounces, bread 2 ounces, and the balance consists of fresh fruits and vegetables. The total amount of fluid is limited to 35 ounces. All sugars and fats are excluded.

Ebstein's method, based on the belief that fat food does not contribute to the body fat, but that this is entirely derived from proteids and carbohydrates, permits fats freely, while limiting the proteids and excluding sugars and starches except such as are contained in a daily allowance of 3½ ounces of bread thoroughly toasted. Three large cups of tea are given daily for stimulation. This diet produces only about 1400 calories.

Oertel's method gives about the same amount of meat and carbohydrates as Banting's, and three times the fat. It produces 1200 calories. It has become popular in treating cases of fatty heart. Fluids are reduced to 36 or 40 ounces. Graduated hill climbing is prescribed to strengthen the heart. The daily menu is as follows (taken from Yeo's *Food in Health and Disease*):

"Morning.—One cup of tea or coffee with a little milk, altogether about 6 ounces. Bread, 3 ounces.

"Noon.—3 to 4 ounces of soup, 7 to 8 ounces of roast or boiled beef, veal, game or not too fat poultry, salad or a light vegetable, a little fish (cooked without fat) if desired, 1 ounce of bread or farinaceous pudding (never more than 3 ounces); 3 to 6 ounces of fruit, fresh preferred, for dessert. It is desirable at this meal to avoid taking fluids, but in hot weather, in the absence of fruit, 6 to 8 ounces of light wine may be taken.

"Afternoon.—The same amount of coffee or tea as in the morning, with at most 6 ounces of water; an ounce of bread as an exceptional indulgence.

"Evening.—One or two soft-boiled eggs, 1 ounce of bread, perhaps a small slice of cheese. Salad and fruit; 6 to 8 ounces of wine with 4 or 5 ounces of water."

Some physicians exclude all fluids from the meals and give hot water two hours after. This is beneficial in many cases, but in persons of feeble gastric digestion it is usually best to allow some water or other beverage.

The Salisbury method is of advantage in some cases of obesity due to overeating, but it is difficult to enforce, since the whole food consists of minced lean beef and hot water. Three meals are given daily, consisting wholly of minced beef, beginning with an ounce or two, the quantity being increased according to the patient's digestive ability to 8 ounces, or, in some cases, to a pound, which is the maximum limit. An hour and a half before each meal and at bed-time, a pint of hot water is drunk slowly.

For anemic patients such vigorous restriction is excessive. The Weir Mitchell treatment is often more suitable. This consists of rest in bed for two weeks, with massage, after which exercise is gradually added. During the first week the diet is reduced until by the end of the week the patient is on an absolute diet of skimmed milk. By

observation, the amount of milk on which the weight is retained is first determined, and the quantity then reduced until the patient is losing half a pound a day. For variety a little soup made of oysters, clams, or chicken is allowed occasionally. If the heart grows weak, more liberal diet is given. Eggs, fish, and meat are the first articles used in changing from the skimmed-milk diet.

Gout.—The greatest difference of opinion has been shown in the recommendations for diet in gout. The very multiplicity of views, based on various theories as to causation, is an indication of our lack of accurate knowledge of the exact nature of the derangement of metabolism which leads to a gouty diathesis and the acute attacks. When the true cause of this derangement has been finally proven, dietetic treatment will become definite and no doubt efficient, but in the present day all that can be positively stated is that gout is a disorder of metabolism and that uric acid is present in some form in excess of normal from deficient excretion.

It was formerly taught that uric acid was due to diminished oxidation of proteids, and those holding this view eliminated this class of food as much as possible from the diet. It has been definitely proven, however, that uric acid is not derived from pure proteid, but from nucleo-proteids.

In view of the unsettled state of opinion respecting the whole subject, it can only be emphasized with regard to gout, what has already been said of dietaries in general, that the diet must, in each case, be suited to the individual. This becomes clinically evident when patients are seen to improve on quite opposite lines of treatment.

Whether uric acid stands in a causative relation, toxic or mechanical, to gout, or whether its retention is the

effect of some other toxic cause of gout, its known derivation from nucleoproteids is an indication for withholding from the diet those foods which are rich in nuclein. Such are the glandular organs used as delicacies, sweetbread, liver, kidney, brain.

As in other diseases, the object of dietary regulations is not only to withhold injurious foods, but at the same time to maintain the patient's nutrition, and this requires foods of all classes. Absolute milk diet has been advocated, but its unsuitableness for adult use alone has been often referred to. It has been suggested, too, that the phosphoric and sulphuric acids, developed by metabolism of albumin, are not neutralized in gout, and by thus increasing the condition of acidæmia they further the retention of uric acid. The large amount of phosphoric acid contained in milk may explain the disappointing results of absolute milk in many persons who not only fail to benefit by such treatment, but grow worse under it. For those who can digest milk, it is a most valuable proteid, since it is lacking in the extractives such as occur in meats, and it should be used in proper amount with other foods.

Meats are to be restricted for the above-mentioned reasons, and because the extractives, in which they are rich, bear a close relation to the xanthine bases, the coproducts with uric acid derived from nuclein. Though restricted, they should not be withdrawn, as they furnish, with milk, the most readily digested proteids. The old belief that red meats were much more injurious than the white, has been shown to be fallacious, and the matter of choice is now left to the patient's taste.

The extent to which fats and carbohydrates should be used is also a mooted question, based on the old theory

of diminished oxidation of proteids as the source of excess of uric acid. The advocates of their liberal administration claimed that this diminished the ingestion of proteids and thus indirectly lessened uric acid formation, while others limited the use of fats and carbohydrates, since by their more ready oxidation they acted as albumin sparers, lessening the oxidation of that substance. In view of the recent determination of the true source of uric acid from foods, these opposed views regarding the use of fats and carbohydrates cease to be of importance.

Of more import, perhaps, than selection as to the quality of food, is the limitation in quantity. After full development of the organs, say at thirty to thirty-five years of age, the body does not need as much food as it did during the period of organic growth. Most persons lose sight of this fact and cling to habits formed in younger days, eating far more than is necessary or beneficial. Such excess taxes the digestive and eliminating organs to a more or less grave extent. Patients with gout must, therefore, be especially instructed as to the proper amount of food which they should take.

A rational diet in gout should be a mixed one and include all classes of food.

Proteid Foods.—Milk, meats, red or white, and fresh fish should be allowed in proper amount to supply proteid waste. Eggs are best withheld, because the yolk contains lecithin. Soups made of meats or of meat stock must be forbidden on account of the extractives which constitute their chief ingredient. There is no objection, however, to vegetable purées or soups made with milk as the base. When milk is indigestible, milk derivatives may be used, such as buttermilk and koumiss. Cheese is usually

permitted, but, as it is for many persons indigestible, it must not be indiscriminately prescribed. Oysters and clams are usually permitted, although restriction in the use of the former would be wise, since it is chiefly composed of liver, an organ rich in nucleoproteids. Salt fish and dried-meat preparations should be avoided.

Fats.—It has been customary to withdraw fats from gouty patients who are corpulent, but Ebstein has shown that the daily use of two and a half to three and a half ounces of butter improves the condition of such patients, and that they lose flesh under the treatment. By the use of fat the carbohydrates, which are more potent flesh-forming foods, can be reduced. Gross fats are injurious, chiefly from the indigestion which they are liable to produce.

Carbohydrates.—Vegetables and fresh fruits may be freely used, with the following exceptions: cabbage, rhubarb, tomatoes, and spinach, because of their content of oxalic acid, a congener of uric acid, which may irritate the kidneys in course of elimination. Tomatoes are now said to contain but little of this objectionable ingredient and are often permitted, though it is a vegetable for which many persons have marked idiosyncrasy. Peas, beans, and lentils should be entirely avoided or allowed in the most limited quantity, since their proteid is not as digestible as the animal proteid, and these foods are prone to produce indigestion with gas formation. Bananas are best avoided since they are liable to produce indigestion. Strawberries should also be forbidden. Farinaceous foods and cereals of all kinds, except oatmeal, may be used. Spices and condiments, sauces, and rich gravies are to be proscribed at all times.

Beverages.—Tea and coffee may be partaken of in small quantities if not strong, provided they do not cause indigestion, which they are much less apt to do if taken without sugar or cream. Tea is constipating to many persons, and should be avoided by those on whom it has this effect.

Water should be freely taken, as it stimulates kidney activity and helps in removing the waste products. At least six or eight glasses should be taken daily. Various spring waters are used in gout, but it is probable in most instances that the chief benefit is from the fact that water is drunk freely rather than because of the mineral ingredients. Three classes of waters are used: those containing a minimum of mineral matter, such as Poland Spring Water; alkaline waters, such as Vichy; and purgative waters, such as Carlsbad and Pluto.

Alcoholic beverages are all injurious in gout, and total abstinence should be insisted upon in the great majority of cases. If the maintenance of nutrition demands alcohol for those habituated to its use, in order to prevent loss of appetite, which might follow its absolute withdrawal, good whiskey and gin are the best preparations. In general, distilled liquors are less injurious than fermented. Malt liquors, heavy wines, such as port and Madeira, and champagne are notoriously harmful.

It must be borne in mind that gouty patients show frequent idiosyncrasy for foods which theoretically would be allowable. They should, therefore, be taught to observe the effect of articles permitted, and their statements concerning the peculiar effects of individual foods should receive respectful attention. In selecting the diet great care must be used to avoid substances which might cause

indigestion; therefore, fried foods, heavy sweets, such as rich puddings, cakes, and pastries, must be forbidden.

Diabetes.—At the outset it should be understood that while the disappearance of sugar from the urine is a desirable thing in diabetes, its presence is not the most important criterion in determining diet. As in other diseases in which the perversion of normal metabolism exists, so in diabetes, the maintenance of proper nutrition is the chief consideration. It is more desirable that the patient should retain strength and flesh, even with some excretion of sugar, than that the disappearance of sugar should be achieved at the expense of weight and vigor.

Glycosuria varies in severity from the cases of simple glycosuria, due to the excessive ingestion of sugars and sugar-forming substances, which are relieved by appropriate diet, to the severe cases of true diabetes for which there is no cure, all dietetic treatment being purely palliative.

In this condition, in which the body has lost its power of utilizing the carbohydrates, their withdrawal would at once suggest itself as a rational method of feeding, and this was previously the custom and practice, and effort was made to supply heat and energy by the excessive use of fats. Many grave objections to this plan exist. Increasing loss of appetite from lack of variety in the diet prevents sufficient food from being taken, and if this misfortune does not arise, intolerance for fat will soon develop and be evidenced by indigestion. It is, therefore, a practical impossibility adequately to nourish most patients on the meat-fat diet alone. Another serious objection to such absolute restriction is that in the entire absence of carbohydrates the development of acetone and oxybutyric acid

is liable to occur, with the production of a condition of acidosis and of diabetic coma. The carbohydrates seem to have the power of increasing the oxidation of the acetone group, thus preventing development of the dangerous coma. Carbohydrates also aid in the assimilation of fats. It will thus be evident that they should not be entirely excluded from the diet, but since it is an indisputable clinical fact that their restriction produces diminution in the amount of sugar, and in some cases even its entire disappearance, with accompanying relief of the general symptoms, the carbohydrates should be limited, the degree of this restriction to be determined in each case individually. There is no dietetic problem that needs greater discrimination or closer observation of the effects of diet than the treatment of diabetes.

The general principle in medicine that functional disturbance requires rest for its relief is applicable in diabetes, and it is customary in beginning the treatment of this disease to withdraw carbohydrates wholly from the diet for a time. This withdrawal, however, should be accomplished gradually, a week being allowed for their complete exclusion, since a sudden change may seriously disturb digestive processes. As the carbohydrates are reduced, the deficiency of diet thus caused must be supplied by proportionate increase of fats. This procedure has the further advantage of giving opportunity to judge of the amount of carbohydrates which a patient can utilize and of the grade of diabetes present. If the sugar disappears from the urine on the withdrawal of sugars only from the diet the case is of the mildest, but if exclusion of all carbohydrates is necessary to cause cessation of the glycosuria the case is considered moderate in severity;

if severe, the sugar will continue as a urinary symptom in spite of such restriction of diet. A non-carbohydrate diet, such as is recommended by Van Noorden, is as follows (taken from Osler):

"Breakfast, 7.30 A.M.—6 oz. of tea or coffee; 4 oz. of beefsteak, mutton chop without bone, or boiled ham; one or two eggs.

"Lunch, 12.30 P.M.—6 oz. cold roast beef; 2 oz. celery, fresh cucumbers or tomatoes, with vinegar, olive oil, pepper and salt to taste; 5 drams whiskey, with 13 oz. of water; 2 oz. coffee, without milk or sugar.

"Dinner, 6 P.M.—6 oz. of clear bouillon; 7½ oz. roast beef; 2½ drams of butter; 2 oz. green salad, with 2½ drams vinegar, 5 drams of olive oil, or three tablespoonfuls of some well-cooked green vegetable; three sardines à l'huile; 5 drams of whiskey, with 13 oz. of water.

"Supper, 9 P.M.—Two eggs (raw or cooked); 13 oz. water."

When this diet has brought about complete disappearance of sugar from the urine for several days, starch may be given in gradually increasing amounts from one-half to three ounces until the reappearance of sugar. Judgment can thereby be formed of the amount of carbohydrates which the patient can take at that period, but it must be remembered that the power of utilizing starches will fluctuate irrespectively of diet, so that such a gauge will not be applicable throughout the course of the disease. Van Noorden believes that by the use of such non-carbohydrate diet the power of the body to utilize this class of food is increased, and he recommends the return to such diet for a week or two at intervals of three or four months, in order to maintain this power. If under such dietetic

restrictions the patient continues to eliminate 0.1 to 0.5 per cent. of sugar, he recommends total abstinence from food for twenty-four hours, which he terms a "hunger-day." This will frequently lead to the disappearance of the sugar with subsequent ability to utilize a small amount of carbohydrates.

Entire deprivation of bread has proved so great a hardship to patients that many substitutes have been exploited. Gluten flour has been tried, but the majority of brands contain so much starch, even more in some instances than wheat flour, that their use is now considered unsafe, and where carbohydrates are permitted, good bread made of wheat flour is preferred, the amount of starch in which is 55 per cent. Bran bread has been used, but unless carefully prepared it is apt to contain a considerable amount of starch, besides a large proportion of indigestible cellulose. Almond flour has proved of service and is used in the form of cakes. Soya-bean flour has also found favor with some persons, though many object greatly to its taste. Potatoes are now used by many physicians in the place of bread, to which they are said to be superior. They seem to have some effect in increasing the metabolism of sugars, and can be given in larger amounts than bread. Their superiority is supposed to be due to the potassium salts contained, which are transformed in the body into potassium carbonate. Potatoes are recommended more for thin than for fleshy persons.

Aleuronat and Roborat flours, which contain a large amount of vegetable albumin, are also recommended.

Sugars.—Grape sugar appears more readily in urine than any other kind, and next to it in this respect is cane sugar. Both should therefore be absolutely excluded

from the diet. Milk sugar is well utilized by many persons; some cannot take it at all. Levulose is by most patients well borne, and it is therefore permissible in most cases. It is usually taken in the form of fruits, as the commercial article is too expensive to permit of its use for flavoring. Saccharin or dulcin may be used to sweeten foods and beverages, but it is best to limit the amount of saccharin to one and a half grains daily, since its constant use in larger amount may lead to gastric disturbances.

Fats should be used in as large quantity as is compatible with good digestion, since it is to them we look to replace the deficiency in the diet brought about by carbohydrate restriction. They generate heat and spare albuminous waste, thus performing similar functions to the carbohydrates. They are given principally in the form of salad oils, fat meats, butter, cream, and cream cheese. Objection has been made to the use of fats because it is probable that acetone is derived from them, especially with regard to butter, which gives the highest acetone excretion of all the fats used for food. In spite of this probable source of acetone, fats must be used because they are essential to the maintenance of nutrition. Van Noorden has shown that the acetone does not increase proportionately with the addition of fats, no increase occurring with butter until more than four and one-half ounces are given. He has further shown that if butter be thoroughly washed, thereby removing the fatty acids which chiefly produce the acetone, it may be given in quantity up to six ounces a day without causing appreciable increase in acetone elimination.

Proteids must be given in as great amount as can be digested, since they are necessary to maintain the tissues and must in this disease be depended upon in part for the

supply of energy. With the development of acidosis, however, they must be reduced or even suspended. All forms of fresh meat (except liver), game, fish, poultry, eggs, and cream cheese may be used. Dried, smoked, and salted meats and fish are all available, and fish preserved in oil, such as sardines, are of much value. Caviar is much esteemed, as it stimulates appetite. Shell-fish are also allowed. Clear soups and broths are permitted. With regard to the propriety of giving milk, opinion has differed and its place in different dietaries has varied from absolute milk diet to absolute exclusion. The determination of the matter will depend upon the patient's ability to utilize milk sugar. Milk is admissible in moderate quantity in many cases, and the addition of it is a ready and useful means of changing from a non-carbohydrate diet.

Fresh vegetables containing much starch or sugar should be excluded, except potatoes, which may be given in amounts proportioned to the patient's ability to utilize them. In some cases as much as two pounds, weighed raw, has been allowed. They should be cooked with the jackets on to save loss of the salts. They should be well matured, and cooked "mealy." Other fresh vegetables having a low percentage of starch or sugar may be used freely. Such are lettuce, cress, spinach, cucumbers, onions, leeks, radishes, asparagus, cabbage, cauliflower, sprouts, mushrooms, green French beans, sauer kraut, dandelion, tomatoes, and various sour pickles.

Fruits which contain but little sugar may be taken in small amount in cases of moderate severity, but all sweet or starchy fruits, such as grapes, bananas, figs, and prunes must be forbidden. Those usually permitted are oranges,

lemons, limes, cherries, plums, acid apples, pears, strawberries, raspberries, blueberries, cranberries, gooseberries, and melons. Nuts, except chestnuts, are allowed.

Beverages.—Pure spring water, Apollinaris, Vichy, and soda water may be taken freely. Tea, coffee, and cocoa nibs may be taken moderately, but saccharin must be used for sweetening them. Alcohol in moderate amount is allowable, since it increases the patient's ability to ingest fats, and prevents disgust for them. Good whiskey and brandy are considered best, and they should be diluted with aërated or alkaline waters. Two to three ounces may be given. Light acid wine, such as claret and hock are also permitted, but all sweet and sparkling wines and malt liquors are to be interdicted.

When a large excretion of acetone bodies occurs, indicating a high degree of acidosis, this becomes of greater immediate concern than the glycosuria, and requires special diet. The condition is caused by too great deficiency of carbohydrates, and these must be given promptly regardless of fluctuations in the amount of sugar in the urine. Under carbohydrate diet acidosis rapidly diminishes and improvement often continues for many weeks after the restricted carbohydrate diet is resumed. For severe or protracted cases Van Noorden advocates an oatmeal cure. His method is to restrict his patient to a gruel or soup made of oat flour, 250 grams ($7\frac{4}{5}$ ounces); butter, 250 to 300 grams ($7\frac{4}{5}$ to $9\frac{2}{5}$ ounces); and Roborat, or some other vegetable albumin, 100 grams (3 ounces). This is given in divided doses at intervals of two hours throughout the day. Under the treatment the elimination of sugar is usually reduced and excretion of acetone falls rapidly. This diet is continued for one or two weeks,

when return to the previous diet must be made, as the patient cannot longer bear the restriction. The return to proteid foods must be very gradual, as otherwise recurrence of acidosis may develop suddenly. The benefit derived from the "oatmeat cure" is removal of immediate danger from acidosis and improvement in the condition, which often lasts for weeks, or even months.

When coma threatens, the administration of levulose may ward off its development. As much as one to three ounces a day has been given with good effect.

Scurvy.—The definite cause of this disease has not been determined, though deficiency in some essential of diet is always present. It is observed among persons who use salt meats and stale foods, and was, at one time, common in navies and armies, in which salt meats and hard-tack formed a large proportion of the regular diet. Insufficient food may lead to its development and lack of the proper variety may induce it.

Although the definite cause is undetermined, it is known empirically that the liberal use of fresh foods will relieve it. Fresh meats should be given with fresh vegetables and fruits. Irish potatoes, oranges, lemons, and limes are of especial value and all of the green vegetables are helpful. When the mouth is too sore to permit of solid feeding, fresh milk and freshly prepared beef juice should be given, with lemon or orange juice, and vegetable juice, or purées.

Chronic Rheumatism.—Conditions in this disease vary so that no routine line of treatment can be given, but the diet must be adapted to each individual according to the digestive ability. Anemia is so often present that meats must be allowed, but they must be used in moderation. Fresh meats only should be given. Green vegetables and

farinaceous foods should, with milk, form the bulk of the diet. In some instances, strictly vegetarian diet seems beneficial. Lemons and oranges are permissible, and water should be freely taken, but alcohol should be forbidden.

Rheumatoid Arthritis.—This is a disease of deficient nutrition, and calls for a liberal diet. Animal foods of good quality should be freely given, together with cereals and fats. Fish, eggs, milk, cream, and butter should appear conspicuously in the diet. Cod-liver oil is a valuable addition if the patient can digest it. In the event of febrile exacerbation, the diet must be reduced, as in acute rheumatism.

CHAPTER XVII.

FOOD IN DISEASES OF THE KIDNEY. ACUTE NEPHRITIS. CHRONIC NEPHRITIS. NEPHROLITHIASIS.

In inflammation of the kidneys, of whatever form, the object of treatment is to spare them work and avoid all substances which could irritate them. In the matter of diet, which is of the greatest importance, practice had got into a routine which was in many details irrational until the investigations of Van Noorden and others pointed out definitely the old fallacies. Not only is the quality of food to be wisely selected, but the quantity must be judiciously limited according to conditions present. Although dietetic restrictions are necessary in order to spare the kidneys the labor of excreting substances which would irritate them, it should be borne in mind that sufficient food must be given to maintain general nutrition and supply the required energy and heat, a fact which has often been lost sight of in an effort to consistently meet the former indication.

Acute Nephritis.—In acute nephritis it is universally agreed that milk is the most appropriate diet, as it is a complete food and easily taken. Its deficiency in carbon may be corrected by the addition of cream in the proportion of half a pint to a quart of milk. In those cases of acute nephritis, in which the amount of urine is greatly lessened, the quantity of milk should be reduced to the minimum, not more than a pint, or a pint and a half, being given in a day. Such reduction of nutriment cannot be continued

for more than a few days, but it is very beneficial, and if the patient is robust it may be of advantage to withhold food entirely for twenty-four hours. In those cases in which the amount of urine, though lessened, is not diminished to a threatening extent, a quart and a half of milk, with the addition of cream as above mentioned, may be given. If more food seems desirable, it would be better to give such additional articles as rice, fine white bread with butter, and unfermented grape juice, than to increase the quantity of milk, since milk contains a large amount of phosphoric acid, one of the substances eliminated by the diseased kidney with difficulty. That which is ingested in the milk administered may be largely neutralized if the patient will take, several times a day, a small dose of calcium carbonate, which forms a compound with the phosphoric acid that is but slightly eliminated by the kidney, the larger proportion passing out with the feces. The natural content of calcium in milk is inefficient to counteract its phosphoric acid, since it occurs in milk in inorganic compounds which cannot combine with this acid.

Water should be given freely as long as the kidneys are able to excrete it. It dilutes the irritating substances, and facilitates their elimination. When, however, water is excreted with difficulty, as is shown by the small amount of urine with increased edema, it should be materially lessened in amount, and thirst should be relieved by giving small bits of ice to suck.

In convalescence all foods must be gradually increased. Milk may be given in quantities of two or two and a half quarts, not more. Bread, legumes, cereals, fruits, and small quantities of eggs or meats may be gradually added to the diet. Water should be freely given in this stage for

the purposes above mentioned, and because it aids the action of the bowels, as well as stimulating the kidney function.

Chronic Nephritis.—This occurs in two forms, familiarly known as parenchymatous and interstitial. The dietetic treatment of the two is quite different, but one principle which they have in common should constantly be borne in mind, that the presence or amount of albumin in the urine is not an indication which should control dietetic treatment, but this must be determined by the general nutrition of the patient and circulatory efficiency.

Parenchymatous Nephritis.—In parenchymatous nephritis, the custom has long prevailed, and is still in many cases followed, of approximating, as closely as possible, an absolute milk diet. The difficulties attending this plan are very great on account of the duration of the condition. Very few succeed in carrying it out strictly, though individuals have subsisted and apparently done well on milk and mineral waters for several months. This is exceptional, however, and such a diet, if persisted in, would, in many cases, do harm.

The principle of dietetic treatment is to protect the kidneys by eliminating from the diet those substances which pass through the kidney with difficulty. From long observations and experiments, Van Noorden states these substances to be urea, creatinin, pigments, hippuric acid, phosphates, inorganic sulphates, potassium salts, water (under certain conditions).

Urea and inorganic sulphates are derived from proteid foods, which should therefore be reduced to the smallest amount compatible with maintenance of the patient's nutrition, and for short periods of a week or two this

reduction may be great. An excess of milk above a quart and a half will be more than required, and therefore harmful.

Creatinin is derived from creatin, which is present in considerable quantity only in meat extracts, meat broths, etc.

The regulation of pigments derived from hemoglobin is hardly to be accomplished by dietetic means, but as hemoglobin ingested with food increases these pigments in the body, it is well to avoid preparations which contain it. Benzoic acid, from which hippuric acid is produced in the body, occurs chiefly in green vegetables, the stone fruits, and cranberries, which should, therefore, be forbidden. The traces of it which occur in other fruits and milk are not of consequence.

Phosphoric acid, from which the phosphates are derived, occurs in large quantity in meat, yolk of egg, and milk. The administration of calcium carbonate is the simple means of counteracting its disadvantages, as above described.

Uric acid and xanthin bases have for a long time been considered injurious in nephritis, though Van Noorden classifies them as relatively well excreted. They are derived from glandular organs used as foods, such as kidneys, sweetbread, liver, etc.

Potassium salts occur in meats and in fairly large percentage in potatoes.

Water is beneficial as long as its excretion is accomplished by the kidneys, but when edema develops and increases, and especially when cardiac dilatation supervenes, as indicated by dyspnea, immediate reduction should be made in the amount allowed.

A suitable diet, then, for parenchymatous nephritis would include a proper amount of milk with an addition of cream; farinaceous foods, such as rice and tapioca; cereals, selected fruit, and fruit juice, of which grape juice possesses especial value; bread, butter, and sugar, and such vegetables as do not contain the irritant substances above enumerated.

If salt is withheld from the diet, diminution of albumin promptly follows and thirst is markedly lessened. The latter effect may be increased by the use of sodium bromide.

Alcohol should be withheld in nephritis until such time as the indication for its use is imperative; then it should be prescribed in necessary amount, as in other conditions.

When edema diminishes and the general condition improves, there is no reason why meats and eggs should not be given in moderate amount, or the diet varied with oysters, clams, and fresh fish.

Interstitial Nephritis.—This is a very chronic disease, extending over years without producing conscious symptoms. Sufferers from this form of nephritis frequently discover its existence accidentally when applying for life insurance. In determining a dietary, therefore, which is to extend over a large portion of a person's life, the question should be not so much what to withhold as what may be allowed. The object here in diet, as in the other forms in nephritis, is to protect the kidney and at the same time maintain nutrition. The diet is of especial importance because it is frequently through dietetic indiscretions, unwittingly committed, that the complications occur which lead to a fatal termination.

In this form of the disease the excretion of waste products by the kidneys is fairly well maintained, except in acute exacerbations and in the terminal stages.

Alcohol is one of the frequent causes of this form of kidney trouble, and should therefore be avoided. In some instances, where the withdrawal of alcohol in persons habituated to its use produces loss of appetite and indigestion, it may be the part of wisdom to permit a small amount for the sake of maintaining appetite and nutrition. Abstinence from alcohol is further indicated by the chronic derangement of the circulatory apparatus which accompanies this kidney disease.

Spices and condiments are especially harmful by the irritation of the kidneys which they produce. While these substances have not been fully investigated, the fact that certain of this class of food accessories are frequently injurious justifies the exclusion, from prudence, of the following: white, black, and Cayenne pepper, paprica, curry, cloves, nutmeg, mustard, anise, leek, garlic, carraway, celery, and truffles.

The use of coffee, tea, and tobacco must be determined by the condition of the heart. If they produce depression or irregularity, they must be abandoned, otherwise, their moderate use is permitted.

In a disease of such long standing, meats must, of necessity, be allowed, though the amount taken daily should be relatively small. The older practice in this disease restricted the patient to the use of white meats, but when such a diet is long continued, distaste develops and the patient will frequently become anemic and weak from lack of sufficient proteid food. The more recent investigations have shown that there is no choice between the white and dark meats, and both are now allowed according to the patient's taste.

Great liberality in the use of water has been the usual

practice, but it is questionable if the patient suffering with this disease is benefited by its great consumption. The lower percentage of albumin, when water is freely given, is usually due to its greater dilution, and the amount of this substance is never a proper indication of the patient's condition. Excessive amounts of water, by increasing blood pressure, throw more work upon the heart, an organ which should be spared in chronic nephritis as much as the kidneys themselves. It is probable that restriction of water, at least to the amount taken in health, would be the best plan.

These suggestions as to diet apply to the fairly mild cases, but it must be remembered that the disease is liable to fluctuation. When exacerbations occur, diet must be instituted, such as described for parenchymatous nephritis. When the end is at hand, however, and there is no reasonable hope of bettering the patient's condition by further food restrictions, much mental distress can be spared and no harm done by regulating the diet according to the patient's tastes.

There are certain conditions often met with in the course of this disease which require special dieting. Threatened uremia demands the temporary exclusion of proteid and the minimum amount of food of any kind. If anemia develops, an increase in the meats must be allowed. The development of cardiovascular symptoms requires reduction in the amount of food and strict limitation of the fluid allowed.

Nephrolithiasis.—During an acute attack of renal colic diet is a matter of no moment, since no food is taken, as a rule. Nor can dietary restrictions in any way effect removal of stones already formed. The purpose is to

prevent enlargement of existing stones or the formation of new ones. When the stone in the kidney is formed of *uric acid*, the diet described for gout gives the appropriate restrictions.

Stones are formed of *oxalic acid* when certain forms of indigestion are present. In these cases a diet suited to the nature of the digestive disturbances should be directed. The following articles, which contain oxalic acid, should be excluded: cabbage, tomatoes, spinach, rhubarb, celery, tea, apples, peas, and possibly onions and turnips.

Phosphatic calculi are formed when the urine is persistently alkaline. This condition arises when an excess of vegetables, with too great restriction of meats, occurs. Milk, eggs, meats, cereals, and bread should form the basis of diet.

In all forms of stones pure water should be abundantly used. Distilled water, Poland water, or any good spring water will be equally effective. Many lithia waters are useful, not on account of merit from the lithia contained, but because they are pure waters, and many persons will drink more regularly of a special water than they will of their customary supply.

Alcohol is best avoided in all of these cases, but if its use is essential to a patient's comfort and willingness to submit to the necessary restrictions, good Scotch whiskey with aërated water may be allowed moderately.

CHAPTER XVIII.

FOOD IN DISEASES OF THE CIRCULATORY AND RESPIRATORY TRACTS. CHRONIC HEART DISEASE. ARTERIOSCLEROSIS. ANGINA PECTORIS. AORTIC ANEURYSM. ACUTE BRONCHITIS. BRONCHOPNEUMONIA. ASTHMA. PLEURISY. FOOD IN ANEMIA AND NEURASTHENIA.

DISEASES OF THE CIRCULATORY ORGANS.

In these diseases dietetic treatment plays a secondary part, as it is not possible by means of it to affect the original diseases; some intercurrent conditions, however, which increase the patient's discomfort or add to his danger may be greatly modified by appropriate dietary measures.

In **chronic organic heart disease** only moderate restriction of the diet is necessary as long as compensation is well maintained and the heart is able to perform its work. The chief object of dietary regulations is to prevent fermentation in the alimentary tract, especially in the stomach, since gaseous distention of the stomach or transverse colon may push the diaphragm upward to such an extent as to encroach upon the heart, producing more or less distress and palpitation. To this end it is necessary to eliminate certain foods from the diet, and the meals should be given at sufficient intervals to insure complete digestion of each before the next is taken. While it is, of course, necessary to give sufficient food to maintain normal nutrition, a certain abstemiousness is nevertheless advantageous, and the quantity of food should therefore be moderate. Twice-cooked foods, potatoes,

beans, and peas in quantity, very starchy foods, and sweets had best be avoided. As a rule, tea and coffee should be withheld, but many persons, who are accustomed to their use, develop increase in the rate and irregularity of the pulse through nervous irritability, if they are withdrawn. In such cases their use should be permitted in moderation. Water should be taken scantily with meals and an excess of fluids should be avoided at all times, as this would tend to raise arterial tension and increase the work of the heart. Alcohol should be abstained from, since the dilatation of vessels, which alcohol produces, increases the possibility of engorgement of the organs, and the increased activity of the heart, under its influence, is more apt to develop cardiac fatigue. Should indigestion develop, it must be relieved as promptly as possible by restricting the diet, if necessary, to the extent of an absolute milk diet. Reducing the diet periodically to absolute milk diet for a few days at a time is advocated in these cases by some practitioners, since it rests the digestive organs and stimulates kidney action, too frequently sluggish in these conditions. By increasing diuresis, arterial tension is reduced.

When compensation fails, the digestive organs suffer, since their circulation is retarded as an effect of the heart's disability. This frequently leads to hepatic engorgement and chronic gastric catarrh. Under such conditions the digestive organs must be spared as much as possible, and concentrated foods, easily digested, are indicated. Milk well meets the indication, as a rule, and has the additional advantage of stimulating the kidneys, an effect which tends to prevent or diminish the development of dropsical effusions. This may be supplemented by other liquid foods, such as raw eggs, egg albumin, and bouillon. As

soon as digestive disorders improve, other foods should be added, such as minced beef or the white meat of chicken, and stale bread. When the liver is markedly inactive the amount of meat should be greatly reduced or wholly withdrawn, because the waste products developed by the imperfect digestion in this class of foods are apt to increase arterial tension. Fluids should be given in sufficient amounts to maintain the volume of the blood and dilute and carry off the waste products, but excess of them should be carefully avoided as tending to add to the labor of the heart and increase dropsical effusions.

Dyspnea is a frequent and often distressing symptom in heart disease. It is much increased by accompanying diseases of the respiratory organs and by gastric and intestinal distention from fermentation. Under the latter circumstances a proper diet, as outlined above, will do much to relieve the condition.

Dilatation of the heart can be much benefited by a dry diet, the object of which is to lessen the work of the heart by reducing arterial tension. Toast, lean meats, a modicum of tea with cream and sugar, and a small amount of milk may be given. Fluids should be withheld to the greatest extent possible without distressing the patient by unbearable thirst. Three or four ounces of water, preferably hot, may be sipped an hour before meals. Two or three days will be sufficiently long to pursue such rigid restriction in acute dilatation; the heart will contract rapidly in that time. As improvement advances, the diet should be gradually increased, though for some time limited in quantity. Chronic dilatation, commonly seen in the aged or as an accompaniment of arteriosclerosis, requires a modified dry diet. Cure is not to be expected, though

great relief often rewards the self-denial required. Food, both solid and liquid, must be limited in quantity and meals should be taken with as little fluid as possible. Three meals are sufficient, and should be taken at intervals of five or six hours, while no food should be allowed between them. Easily digested meats and fish, toast with a little butter, a small amount of fruit, such as pears, apples, and grapes, oatmeal, potato, and spinach are permissible foods. All vegetables and fruits which contain a large amount of water should be avoided. It is recommended that a glass of hot water be taken three or four hours after each meal.

Arteriosclerosis.—This condition is so frequently concomitant with chronic nephritis that dietary regulations must often be such as are given for that disease. One of the frequent causes of arteriosclerosis is overeating, especially of highly seasoned and rich meats. This is due to the development of toxins from meat, which increase arterial tension while circulating in the blood, and thus strain the vessel walls. This condition is furthered by irritation produced in the digestive tract by the abuse of spices and condiments, leading to the insufficient digestion of the meats. Such foods should therefore be excluded, although in mild cases a moderate amount of easily digested meats, such as chicken, beef, and mutton may be permitted occasionally. Alcohol should be prohibited, since its habitual use is often the cause of this affection. Absolute milk diet may temporarily be instituted with advantage when excessive tension is accompanied by headaches, insomnia, and nocturnal distress. Fewer toxins are developed from milk than from other proteid foods, and it tends to lower vascular tension by increasing

diuresis. Eggs may sometimes be combined beneficially with milk, but such restriction of diet should not be long continued. Flatulence should be avoided by interdicting foods which are slowly digested and prone to fermentation, such as cabbage and beans. Indigestible foods, as pastries, gross fats, and very sweet foods, should also be forbidden. Alkaline and laxative mineral waters are useful. The patient must be cautioned against overeating, even of the wholesome articles allowed. Bread, cereals, vegetables, and fruits, with milk, and sometimes eggs, must be the main reliance.

Angina Pectoris.—Restriction of diet in angina pectoris seeks to lessen arterial spasm. Limitation or withdrawal of meats is essential because they are the most productive source of irritating toxins, which lead to contraction of the vessels. Fluids should be taken only in a sufficient amount to relieve thirst, in order to avoid increase in the volume of the blood and consequent high pressure in the arteries which excess would cause. The total quantity of food should be reduced, and just sufficient taken to maintain nutrition.

Aortic Aneurysm.—In this condition the object of treatment is to diminish arterial tension and to favor coagulation of the blood within the aneurysmal sac. The old treatment of reduction of the blood volume by bleeding and a starvation diet was long ago abandoned, and even the modified treatment of Tufnell of a greatly reduced diet without bleeding is not now favorably considered, except in cases of traumatic origin. Such methods would certainly seem irrational where degenerative tendencies have produced the aneurysm, as the anemia which develops under these plans would tend to increase the

dilatation. Practically but little can be done by dieting. Restriction of fluids and the withdrawal or the reduction of meats will reduce tension in the vessels, and the diet should be much the same as that suggested for angina. Gelatin has been given in large amount to promote blood clotting, and in recent years success has been achieved in many instances by the subcutaneous injection of sterilized gelatin solution. This is used in strength of 1 or 2 per cent., sometimes as high as 5 per cent., four to eight ounces being administered. Diminution and disappearance of pain, less violent pulsations, and contraction of the sac are the good results observed.

DISEASES OF RESPIRATORY ORGANS.

In this class of diseases, as in diseases of circulatory organs, diet is for the most part a matter of secondary importance, the chief object being to avoid indigestion as a source of greater discomfort to the patient.

Acute Bronchitis.—In acute bronchitis, if the attack is severe and fever is present, the restriction of diet to fluids, as directed for acute infectious diseases, is best. When milk can be readily digested by the patient, it will form the basis of diet, but other preparations, such as egg albumin, may be used. If the case is a mild one, foods of soft consistency, which are easily digested, may be used; eggs, soft-poached or boiled; farinaceous articles, such as blanc mange and cornstarch; milk toasts, cereals, minced chicken, and minced beef. In the early stages, when the cough is harassing and expectoration scant, the free use of fluids will tend to assist the expulsion of mucus by making the secretions thinner. Hot drinks are often

more comforting than cold; water, milk, lemonade, tea, or punch may be used.

Bronchopneumonia.—In bronchopneumonia the same general rules as to diet should be observed as in simple acute bronchitis of a severe type. Alcohol is extensively used in this condition, and it does good by lightening the work of the heart and lessening internal congestion by its effect of dilating the cutaneous vessels and lowering blood pressure. In very severe cases the question of maintaining nutrition often becomes a serious one, because of loss of appetite and the unwillingness of the patient to take food, since it often increases the distressing cough. In such cases it may be necessary to resort to rectal feeding.

Chronic Bronchitis.—Persons suffering from chronic bronchitis must be allowed an ordinary, wholesome diet, as in health. The chief point of dietetic interest regards the amount of fluid to be taken, which is determined by the character of the secretions. When these are thick and tenacious, the free use of fluids will tend to facilitate their expulsion; any non-stimulating drinks may be taken according to the patient's preference. A cup of hot tea is often comforting, or lemonade, hot or cold water, milk or grape juice may be used.

Asthma.—Indiscretions of diet bear an important causative relation to attacks of asthma. Regulation of diet in this disease is therefore of importance. The details of restricted articles have to be determined for the individual case, since most of these patients show more or less idiosyncrasy for special articles of food. In general, they should avoid all forms of food which are digested with difficulty, and the amount of food taken should be limited to moderation. The evening meal should be a

light one, the heaviest meal being taken at midday. Fluids should be taken sparingly with meals, but may be used between meals. A cup of hot water, given an hour before each meal, will lessen thirst. Highly seasoned articles and coarse meats should be interdicted. Strong coffee is often helpful in allaying the attacks, and it is best used without sugar or cream. Constipation increases the liability to asthmatic seizures, and should be prevented by a diet such as has been recommended for that condition, so far as it is compatible with the idiosyncrasies of the individual.

Pleurisy.—No special dietetic measures are needed before effusion occurs other than the usual restrictions in febrile conditions. Efforts may be made to bring about absorption of the effusion by restricting the amount of fluid. Such restrictions should not, however, be carried to the extent of producing great discomfort, as this dietetic measure frequently fails of its desired effect, and the fluid may be otherwise effectually removed, when this becomes a necessity. Tender meats, chicken, fish, bread with butter, stewed fruits, potatoes, cereals, and occasionally a small amount of green vegetables may be allowed. Schrott's dry diet consists of lean roast veal with stale rolls, and no fluid, except a very little water for three days, after which a half-pint of red wine is allowed, and at the end of a week this is increased to one pint. This method has been popular with some physicians, but is a hardship to patients.

ANEMIA AND NEURASTHENIA.

Anemia.—The different forms in which anemia presents itself clinically vary in symptoms and in gravity.

The causes have not been definitely determined, though in each instance numerous conditions are known to be contributing factors. While medicinal and hygienic treatment differ considerably, the dietetic treatment is along the same lines in all forms of the condition.

In chlorosis deficiency of hemoglobin is the characteristic blood finding, while in secondary pernicious anemia diminution in the number of red blood cells is the special feature. Either condition will bring about a lack of hemoglobin, which therefore lessens the total amount of oxygen in circulation and leads to consequent nutritional changes. The metabolism of proteids increases, as is shown by the greater amount of urea eliminated, while the oxidation of fats is diminished. This leads to flabby and feeble muscles, including the heart, although the fat may be deposited, giving the patient an appearance of plumpness, which is often deceptive. The alteration in the blood lessens the nutrition of the organs of the body, hence secretions are not normal, and digestive processes are defective. The indications for feeding therefore are to supply nutriment which will furnish the materials for the restoration of the diseased blood and renew the tone of the weakened muscles. Because of the feebleness of the digestive functions and the weakened circulation, it is essential that articles of food should be selected which can be readily digested and absorbed, and that they should be prepared by such methods as will enhance their digestion. They should be served in an inviting manner, as appetite is usually wanting. It is evident, therefore, that proteid foods should be abundantly supplied; the best, when it can be digested by the patient, is milk. This should form a conspicuous part of the diet, but when it proves indi-

gestible for the patient, and modification fails to render it digestible, it is a mistake to force it. Distaste for milk can often be avoided by alternating with it some of the milk derivatives.

Eggs are of special value in that they afford a concentrated proteid food rich in iron. They may be given in any form.

All kinds of meats are useful, especially the beef preparations, such as expressed beef juice, scraped beef, and minced raw beef. When the patient's digestion will permit, meats should be given, such as steak, roasts, chicken, etc. While the patient is on a diet consisting chiefly of proteids, special care should be taken to see that they are thoroughly digested.

Fat is essential to cell growth and should be properly supplied in the diet of anemia. Butter is the most easily digested fat, and it or cream should be given daily. If the patient does not object too greatly to the taste of cod-liver oil, it may be given in moderate amount. Crisp breakfast bacon is a good form in which to administer fat, and by its pleasant flavor it often stimulates the appetite.

Fresh green vegetables and cereals will tend to prevent the constipation usually present. They have the further advantage of introducing a considerable amount of organic iron into the body. Green vegetables are best administered in the form of purées. Macaroni and spaghetti, rice, baked potatoes, whole wheat, and Graham bread are also good.

Condiments in very moderate amount are useful in inducing a greater consumption of food; salt especially should be freely used, as it aids in the restoration of blood cells and improves the quality of blood plasma. Water

should be taken freely as in other conditions in which a nitrogenous diet is given, in order to dilute the waste products and facilitate their elimination. Stimulating beverages should be withheld, especially alcohol, since it lessens the oxygen-carrying power of the red blood cells, which would aggravate the condition from which relief is sought. Malt extract is often helpful.

Fruits, if not too sweet, are permitted many chlorotic patients. They often crave sweets or acids, but these should be withheld, except oranges and lemons. Indulgence in candies and pastries is to be strictly forbidden, since they produce disturbance in the alimentary tract, which interferes with the digestion of other foods. Pickles are in like manner harmful, and have the special disadvantage of introducing a considerable amount of vinegar, which tends, by reducing the alkalinity of the blood, to increase the anemic condition.

Neurasthenia.—In this condition the diet forms but part of the necessary treatment, and in some cases dietary restriction may be limited to the exclusion of certain indigestible articles, such as pastries, pickles, and sweets. Many cases, however, are attended with digestive disorders and malnutrition, which require special dietetic regulations. When anemia is present, as is not infrequently the case, such diet as has been described for that condition will be appropriate. When emaciation is marked and muscular strength greatly lessened, the Weir Mitchell rest cure is the recognized treatment. The patient is put to bed and not allowed to rise, except to empty the bladder or bowels. To insure complete rest she is fed by the nurse. During the period of rest in bed, massage and electricity are used with sufficient vigor to

insure the elimination of waste products. The diet at first consists of milk only, which is given in the first few days in amounts of three to four ounces every two hours, and then increased to two quarts a day, administered in divided doses every three hours. A little coffee, without sugar, is permitted in order to prevent constipation, or some simple purge is given. At the end of the week raw-beef soup is added, and a day or two later a mutton chop is given for dinner. Bread with butter is then permitted, the milk meanwhile being continued. The diet is gradually increased by the addition of eggs, simple vegetables, and stewed fruits, until three simple, but abundant, meals are taken daily, besides three or four pints of milk. Absolute recumbency is insisted upon while the milk diet is maintained, but when three meals are taken the patient is permitted to sit up while eating. The hours out of bed are gradually increased, though for some time frequent periods of rest during the day are required. The stools must be carefully watched and the appearance therein of undigested food will necessitate a diminution in the amount given; excess of urates in the urine will also be an indication for diminishing the amount of food.

Alcohol is best forbidden, as it is not necessary, and patients of the type who require the rest cure are peculiarly prone to the development of the habit.

CHAPTER XIX.

FOOD IN DISEASES OF THE SKIN. ACNE VULGARIS. ACNE ROSACEA. ECZEMA. ERYTHEMA NODOSUM. PSORIASIS. PURPURA. URTICARIA. XANTHOMA DIABETICORUM.

In view of the close physiological relationship between the skin and the functional activity of the other organs of the body, it is not surprising that various eruptive disturbances of the cutaneous system may often be traced to disorders of the stomach, intestines, or liver, caused by improper feeding. This is often the case where the food, being inadequate in quality or quantity, lowers nutrition, as the lack of vegetable diet producing scurvy or the directly irritating effect of oatmeal or other cereals upon the gastrointestinal mucous membrane in eczematous or urticarial patients.

The excessive ingestion of starchy foods by infants, especially when there is a catarrhal inflammation of the mucosa, frequently leads to the development of an eczema. Certain diseases are attributable to the use of special foods, as pellegra to the consumption of decomposed maize.

All foods or condiments very stimulating or difficult of digestion should be avoided, not only because they disturb digestion, but because they usually leave some trace of their evil influence on the skin.

Acne Vulgaris.—In a disease which is so frequently associated with gastrointestinal disturbances, it should be readily appreciated that a proper diet is necessary for the successful management of the case. The diet should be

non-stimulating, all indigestible foods and highly seasoned dishes being avoided; sweets, pastries, cheese, and all fried foods should be forbidden, while butter, cream, and other fats should be allowed unless they cause gastric or intestinal disturbances. An ample diet of fish, fruit, and the lighter vegetables will usually have a beneficial effect even upon the most aggravated cases.

The patient may take:

SOUP.—Clear.

FISH.—Boiled or baked. Roe herring. Oysters: raw, stewed, scalloped.

EGGS.—Raw, soft-boiled, baked, poached.

MEATS.—Fowl, game, rare roast, boiled, steak, chops, crisp breakfast bacon.

FARINACEOUS.—Toast, stale bread, corn bread, Sally Lunn, quick muffins, beaten biscuit, rice, tapioca.

VEGETABLES.—Spinach, turnip salad, kale, corn, green peas, celery, asparagus, onions, salsify, boiled or baked potatoes (in moderation), lettuce without dressing.

DESSERTS.—Cream, plain jelly, fruits, melons.

BEVERAGES.—Tea, coffee, cocoa occasionally, buttermilk, sweet milk, water in abundance.

He must avoid all vegetable or highly seasoned soups, all fried foods, gravies, pickled or corned meats, sausage, meat or vegetable salads, oatmeal, freshly baked bread, griddle cakes, etc.; cabbage, cauliflower, lettuce with dressing, turnips, carrots, parsnips, beets, cucumbers, radishes, tomatoes, cold slaw, pastry, pies, jams, candies or candied fruits, pudding, cakes, and all alcoholic stimulants and tobacco.

Acne Rosacea.—Individuals with acne rosacea should refrain from indulgence in very hot drinks, as soup, coffee,

etc., which produce an increase in the congestive disturbance of the face. This class of patients is particularly susceptible to the injurious effects of improperly made tea. Boiling or steeping tea for an indefinite length of time produces an infusion of tannin which is very harmful to the digestion, resulting in constipation and other kindred troubles. All alcoholic stimulants and tobacco should be avoided.

The patient may take:

Soups.—Clear, cream.

Fish.—Boiled, baked. Oysters: raw, stewed, scalloped.

Eggs.—Raw, soft-boiled, baked, poached.

Meats.—Fowl, game, red meats in moderation.

Farinaceous.—Bread one day old, corn bread, brown bread, Sally Lunn, quick muffins, beaten biscuit, rice, tapioca.

Vegetables.—Spinach, turnip salad, kale, corn, green peas, celery, asparagus, onions, salsify, boiled or baked potatoes, lettuce without dressing.

Dessert.—Cream, fruits, melons.

Beverages.—Tea, very weak and not too hot; weak cocoa, milk, and abundance of water.

To be avoided are highly seasoned and vegetable soups, all fried foods, all salads, gravies, pickled or corned meat, oatmeal, freshly baked bread, doughnuts, griddle cakes, waffles, cabbage, cauliflower, lettuce with dressing, turnips, carrots, parsnips, beets, cucumbers, radishes, tomatoes, pickles, cold slaw, pies, pastry, jams, candy, or candied fruits, puddings, cakes.

Eczema.—In a condition that occurs in connection with almost every constitutional disease it would be impossible

to lay down a rule regarding the diet. In eczema, each case should be given the quantity and kind of food that will best nourish the tissues without producing evil effects upon digestion and elimination. The anemic and strumous patient should be given an abundance of beef, mutton, eggs, cream, fats, and easily digested vegetables. On the other hand, for the overfed, plethoric, and gouty patient, especially when elimination is defective, the diet should be as simple and at the same time as nutritious as possible. Many of these cases show the most gratifying improvement from a diet restricted to toast and milk. Alcohol in all forms is contraindicated save in the aged and debilitated. In diabetic eczema the regimen proper in glycosuria should be observed.

The eczematous patient may take:

Soups.—Small quantity. Clear soups of beef, mutton, oyster. Clam broth, oyster broth, chicken broth.

Fish.—Raw oysters, white fish, shad, cod, perch, trout, bass, smelt, fresh mackerel.

Meats.—Meat juice (raw), roasted beef, chicken, tongue, squab, roast partridge.

Eggs.—Raw, soft-boiled, baked, poached.

Farinaceous.—Bread at least one day old, brown bread, toast, rye, gluten and Graham bread, zwieback, crackers, cream crackers, rice, sago, tapioca, crumbs, arrowroot, cornmeal pone, Graham grits.

Vegetables.—Greens, spinach, lettuce, water-cress, French beans, sweet corn, green peas, asparagus, celery, artichokes, boiled onions, salsify, potatoes moderately.

Dessert.—Orange charlotte, gelatin creams, blanc mange, baked and stewed apples and pears, figs, prunes, tamarinds, melons.

BEVERAGES.—(Drinks should mostly be taken near the end of and between meals.) Hot water before meals, milk, lime-water, Vichy, weak tea (one-half ounce to the pint), koumiss, weak cocoa, peptonized cocoa and milk, buttermilk, malted milk, leguminose-cocoa, whey, equal parts of whey and unfermented grape juice. Black coffee and lemon juice on first rising. Tea and coffee disagree in many cases. Mineral waters: carbonic water, Congress, Hathorne, Kissingen, Apollinaris, Buffalo Lithia, Chase City Chloride Calcium, Rubinat.

STIMULANTS.—Whiskey or brandy well diluted, in debilitated subjects.

Must avoid: rich soups and chowders, all fried foods, hot or fresh bread, griddle cakes, oatmeal, doughnuts, veal, pork, liver, kidney, hashes, stews, pickled and corned meats, preserved and potted meats, turkey, goose, duck, sausage, salmon, salt mackerel, salt meats, sturgeon, shrimps, sardines, lobster, crabs, cabbage, cauliflower, radishes, cold slaw, cucumbers, parsnips, egg-plant, turnips, carrots, squash, beets, pastry, pies, made dishes, nuts, dates, jams, dried and candied fruits, candies, cheese, strong tea, ice-water, malt liquors, sweet and effervescent wines.

Erythema Nodosum.—Inasmuch as this condition is associated with gout, rheumatism, and malaria the dietary is identical with that indicated for these diseases.

Psoriasis.—The diet in psoriasis must be determined by the general physical condition of the patient. To those of a plethoric habit meats should be allowed only in small quantities, while it is often advisable to prohibit it entirely for a while. On the contrary, the anemic and strumous individual should be allowed a rather liberal diet with a full quantity of meat.

The plethoric patient may take:

Soups.—Clear.

Fish.—Boiled or baked. Oysters: raw, stewed.

Eggs.—Soft-boiled, poached.

Meats.—White meat of fowl, squab, roast quail.

Farinaceous.—Bread one day old, brown bread, Graham bread, corn bread, zwieback, rice, tapioca.

Vegetables.—Spinach, snaps, corn, green peas, celery, onions, salsify, small quantity of potatoes.

Desserts.—Figs, prunes, baked apples, pears, tamarinds, gelatin, creams, melons.

Beverages.—Weak tea, coffee, milk, abundance of water between meals.

He must avoid highly seasoned or vegetable soups, all fried foods, all salads; all red, pickled, or potted meats; freshly baked breads, cereals, doughnuts, griddle cakes, cabbage, cauliflower, lettuce, egg-plant, turnips, carrots, asparagus, beets, cucumbers, parsnips, tomatoes, radishes, beans, peas, cold slaw, pastries, jams, candies, fruit creams, wine jellies; strong tea or coffee, alcoholic stimulants, and tobacco.

The anemic and strumous patient may take:

Soups.—Clear.

Fish.—Boiled, baked. Oysters: raw, stewed.

Eggs.—Raw, soft-boiled, poached.

Meats.—Beef, lamb, fowl, game, meat juice.

Farinaceous.—Stale bread, toast, corn bread, brown bread, rice, tapioca.

Vegetables.—Spinach, snaps, corn, green peas, celery, onions, salsify, potatoes in moderation.

Desserts.—Fruit, tamarinds, melons, nuts.

Beverages.—Milk, cream, koumiss, peptonized cocoa, weak tea.

STIMULANTS.—Whiskey for the debilitated and aged.

Purpura.—Individuals suffering with any one of the three varieties of this condition should have an abundance of the lighter vegetables, especially those rich in iron, as spinach. The red meats should for a time be withheld. Asparagus should be avoided, as cases have been reported in which this vegetable has proven an etiological factor. Stimulants should be withheld in cases of purpura simplex, but are indicated in the hemorrhagic type and when the patient is very debilitated.

The patient may take:

SOUP.—Clear.

FISH.

EGGS.

MEATS.—Fowl, sweetbread, game.

FARINACEOUS.—Corn bread, stale bread, Graham and rye bread, rice, tapioca.

VEGETABLES.—Boiled or baked potatoes, onions, corn, spinach, egg-plant.

DESSERTS.—Fruit, melons, cream, ices.

BEVERAGES.—Tea, milk, ferruginous waters, lemon, and orange albumin.

He must avoid vegetable and highly seasoned soups, all fried foods, red meats, freshly baked breads, cereals, cakes, peas, beans, asparagus, tomatoes, cabbage, beets, parsnips, salsify.

Urticaria.—It is remarkable and yet apparently true that there is no one article of diet entirely harmless to all individuals with a predisposition to the development of urticaria. To persons with such an idiosyncrasy the distressing result of indulgence in some special article of food is frequently out of all proportion to the quantity of

that article taken. A single strawberry or one sip of beer may induce an urticarial eruption covering a large per cent. of the surface. Therefore, it is well to remember that the smallest amount of an apparently innocent food ingested may be responsible for the greatest inconvenience. Unless possessed of an idiosyncrasy against some one of the following, the patient may usually take:

SOUPS.—Clear, cream.

MEATS.—Fowl, game, broiled steaks, rare roast, sweetbreads.

FARINACEOUS.—Toast, stale bread, corn bread, muffins, beaten biscuit, rice, tapioca.

VEGETABLES.—Potatoes (boiled or mashed), lettuce without dressing, egg-plant (stuffed), beets.

DESSERTS.—Plain cream, melons, baked and stewed apples.

BEVERAGES.—Weak tea and coffee, milk, water.

The following are the most frequent offenders: Vegetable and highly seasoned soups, oyster and clam broth, fish, eggs, pork, sausage, lamb, pickled and corned meats, griddle cakes, peas, beans, onions, garlic, corn, mushrooms, spinach, pickles, tomatoes, cabbage, all berries, pineapples, figs, prunes, dates, raisins, skin of grapes, alcoholic stimulants of all kinds.

Xanthoma Diabeticorum.—Persons suffering from this disease may take:

SOUPS.—Clear, of beef, veal, chicken, oysters, and clams, mock turtle, tomato, oxtail, gumbo; all soups without flour.

FISH.—Cod, mackerel, soft-shell crabs, pan fish, shrimps, clams, oysters (raw, steamed).

MEATS.—Especially fats, in beef, lamb, fowl, game, calf's head, bacon, tongue, tripe, egg.

Relishes.—Sour pickles, radishes, celery, olives, cream cheese.

Farinaceous.—Gluten bread, wafers, gluten porridge, fired gluten mush, almond bread and cakes, bran crackers.

Vegetables.—Lettuce, cucumbers, spinach, cauliflower, cabbage, tomatoes without sugar, salsify, onions, snaps, asparagus, mushrooms, okra.

Desserts.—Almonds, hazelnuts, walnuts, cocoanuts, ice-cream sweetened with saccharin.

Beverages.—Tea and coffee with saccharin, koumiss; Buffalo, Bethesda, Saratoga, Poland, and Londonderry waters.

They must avoid soups containing cream, flour, or sugar; stewed oysters, fried oysters, and fish prepared with sauces containing flour; liver, breaded meats, stuffed meats, sweetbreads, kidney hash, all stews containing potatoes, thickened gravies, sweet pickles, all wheat bread, rice, sago, tapioca, cereals, maccaroni, beets, sweet and Irish potatoes, beans, peas, parsnips, turnips, and all sweet vegetables, sweet fruits, melons, chestnuts, peanuts, candies, sweet rices, jams, honey, milk and sugar in tea and coffee.

CHAPTER XX.

MEMORIAL HOSPITAL DIETARIES. RECIPES.

The details of diet differ in hospitals for various reasons. As a specimen of the qualitative selection, the following dietary of the Memorial Hospital, Richmond, Va., is given:

DIETS.

The official diets are three in number, viz.: general house diet, soft diet, and liquid diet.

As a substitute for these, there may be furnished, on the order of the attending physician and surgeon, any special or restricted diets.

General House Diet.

Cereals.—Not limited; the standard cereals being oatmeal, cracked wheat, cornmeal mush, batter bread, rice, barley, hominy grits, and grape-nut.

Griddle Cakes, etc.—Limited to batter cakes (cooked on soapstone griddle), baked hominy, cornmeal, and Graham-flour gems.

Eggs.—Served frequently and in all ways, except fried and hard-boiled.

Purées and Soups.—Not limited.

Meats.—Beef, lamb, mutton, sweetbreads, brains, calf's brain, veal, ham (boiled or baked, served once weekly).

A small slice of crisp bacon allowed with peas, eggs, and scalloped apples. Corn beef and smoked tongue once weekly.

Game.—Venison, duck, quail, squabs, reedbird, and robins.

Fowls.—Turkey and chicken (broiled, stewed, and baked).

Water Food.—Fish, all kinds; planked, baked, boiled, and broiled. Roe herring served every breakfast; oysters, stewed, raw, broiled, and scalloped.

Vegetables.—All kinds, omitting cucumbers and cabbages only.

Salads with Mayonaise.—Tomatoes and celery, chicken, lettuce, snap, asparagus, sweetbread, tomatoes, and lettuce.

Cheese.—Cream and Neuchatel.

Beverages.—Tea, coffee, cocoa, hot-water tea, nutritious coffee.

Breads.—White, whole wheat, spoon bread, muffins, gems, rye, and pulled bread.

Crackers.—Mushroom, cream, soda, oatmeal, and saltine crackers.

Table and Mineral Waters.—Vichy, Apollinaris, filtered James River.

Fruits.—All kinds, omitting bananas, unless cooked.

Desserts.—Limited to ices, frozen custard, sherbet, creams, charlotte russe (frozen), jellies, simple puddings, and blanc mange.

Cakes.—Lady fingers (over twenty-four hours old), toasted sponge cake, molasses, and honey cakes.

Nuts.—Almonds and English walnuts.

Soft Diets.

Gruels.—Oatmeal, barley, arrowroot, flour, cracker, farina, cornmeal, Racahout des Arabes, Imperial Granum.

Mush and Porridge.—Oatmeal, cornmeal, farina, wheat, Imperial Granum, granula, rolled wheat, hominy, flaked rice, banana mush.

Eggs.—Raw, poached, soft-cooked (cooked at temperature of 160° F.), boiled custard, baked custard, egg gruel, egg with junket, scrambled eggs (beaten lightly with milk), foamy omelet, yolk of hard-boiled eggs (cooked two hours).

Breads.—Batter bread (Southern style), egg bread, milk toast, water toast, cream toast (a little nutmeg grated on top renders it more agreeable). Stale bread frequently allowed.

Crackers.—Arrowroot, mushroom, cream soda, saltines.

Soups.—Broths, beef teas, purées made with and without milk, and all strained soup (great care should be taken that all fats are removed).

Water Food.—Raw oysters (hearts removed), oysters peptonized, oysters stewed (remove heart and subject to fire until the edges or gills begin to curl). White fish (those containing comparatively little fat), cod, haddock, turbot, halibut, flounder, trout. Serve creamed or boiled, using a simple sauce or little drawn country butter.

Sweetbreads, Game, Fowls, etc.—Chicken purée, chicken panada, chicken stewed. (See that chickens are young and well nourished.) Squab, partridge or sora frequently allowed. The flesh of game is easily digested if properly cooked; the meat of breast especially adapted for invalid use. Sweetbreads, creamed; brains, creamed (not

especially recommended, containing too much fat and cholesterin, although fairly digestible).

Tripe.—(Honeycomb portion) creamed, easily digested, though containing rather too much fat (16 per cent.).

Desserts.—Soft custard, baked custard, rice custard (omit raisins), farina custard, cornstarch custard, sago custard, frozen custard, junket, arrowroot pudding, lemon pudding, rice pudding, tapioca pudding, wine pudding, cocoa pudding (omit raisins), plain ice-cream (not fruit), charlotte russe (frozen), various ices and sherbets, Irish moss, blanc mange, cornstarch, jelly (gelatin), jelly (calf's foot), jelly (isinglass), jelly (calf's head), apples baked, bananas baked, pears baked, apple float, peach float, prunes, stewed fruits, raw fruits, oranges, shaddocks (juice only), ripe peaches.

Solid Meat Preparation.—In addition to the fluid preparations of meat—viz., broths, juices, teas, jellies—the solid meat preparations are frequently included in soft-diet menu. These solid meat preparations being prepared from scraped beef (best made from tender steak), are easily digested when properly cooked, as the indigestible and less nutritious connective-tissue sheaths of the muscle fasciculi are broken and left out, while the myosin is served in the form of a soft, digestible mass. Before cooking, the pulp is still further improved by passing two or three times through a sieve.

Raw Meat.—Beef pulp, scraped-beef sandwiches, meat rolls, digested beef (with twenty drops of dilute hydrochloric acid), meat extract, beef marrow on toast.

Beverages.—Cocoa, milk, buttermilk, strained soup, albumins, broths, beef juices, extracts, etc. Omit coffee and tea, although these are allowed by some.

Liquid Diets.

Different Ways of Serving Milk.—Milk: peptonized, boiled, sterilized, and pasteurized. Milk with lime-water, Vichy, Apollinaris or other sparkling water, and soda, water. Milk with equal parts of arrowroot-water, rice-water, or barley-water. Albuminized milk or milk with white of egg. Milk with yolk of egg and milk flavored with vanilla, cinnamon, or nutmeg. Milk punch (with whiskey, sherry, or brandy), milk and egg (eggnog), koumiss, milk with coffee (nutritious coffee), whey with wine or lemon juice, whey with champagne, whey with pepsin or rennet, milk lemonade, junket, milk jelly (Irish moss); cocoa, hot or cold, served with cracked ice; cocoa, junket, milk with oyster broth or clam broth, equal parts; milk with chicken broth, equal parts.

Beef Juices, Beef Teas, etc.—Beef juice, beef essence, beef tea, beef broth, and chicken broth, consommé or bouillon, beef jelly with gelatin or Irish moss, mutton broth, chicken jelly, plain or jellied with Irish moss or gelatin, clam and oyster broth; clam juice, calf's-foot jelly, Chrysties' beef tea (made by adding sodium chloride and dilute hydrochloric acid); strained soups, made from soup stocks.

Egg Preparations. — Albumin-water, flavored with orange juice, lemon juice, pineapple juice, grape juice, and apple juice; may also flavor with whiskey, rum, sherry, or few drops of oil of cinnamon; albumin and milk, consommé and eggs, broths with eggs, nutritious coffee and egg. Eggs served raw, or with orange, sherry, water, wine, lemonade, whiskey, etc.; beef tea and egg, mulled wine, eggs with milk and flavored.

Farinaceous Liquid Foods.—Toast-water, rice-water, oatmeal-water, barley-water, arrowroot-water, gum arabic and cereal extract (all demulcent and nutritive).

Beverages.—Orangeade, lemonade, apple juice with ice, cider, grape juice with ice, pineapple juice with ice, ginger ale, tamarind-water, fruit soda (use siphon soda), wine and fruit jelly heated before serving; root beer.

RECIPES.

Fluid Meat Preparations.

Beef Juice.

Beef Juice (Broiled).—Broil quickly pieces of the round or sirloin (all fat removed), of a size to fit opening in a lemon squeezer. Both sides of the beef should be quickly scorched to prevent the escape of the juices, the interior should only be heated through. Squeeze out the juice with a meat press or lemon squeezer which has previously been dipped into boiling water. The juice should be received into a hot wine glass. Season with salt and pepper and it is ready to serve. It may be taken either hot or cold.

If necessary to heat it, put it into a cup and place it in a dish of warm water on the fire. Care should be taken that the water does not become hotter than 160° F.; for beyond that temperature the albuminous juices become coagulated and appear as brown flakes.

It may be served with an equal quantity of warm water (not boiling), or pour the juice over toast, or crumbs of toast, or batter bread.

Bottled Beef Juice.—Select and prepare the meat in the same manner as for beef juice prepared by broiling steak, only divide it into small pieces, put them into a glass jar, cover and place in a deep saucepan of cold water; heat gradually for one hour, but do not allow the temperature at any time exceed 160° F.; then strain out the juice and press the meat. The liquid should be clear red, not brown and flaky. Add a little salt and pepper and it is ready to serve.

One pound of beef will make about eight tablespoonfuls of juice.

Beef juice may be made into tea by diluting it with warm water.

Beef Juice (*Cold Process*).—Select beef from tender side of round or the sirloin (free it from all fat), chop it very fine, or better still, run it twice through a meat grinder. Place one pound of this beef with one gill of cold water in a jar, with a tight-fitting lid, and stand on the ice for eight hours or overnight (when possible shake occasionally). Strain through a muslin bag, twisting ends in opposite directions. Season with salt and pepper and serve cold or slightly warmed.

Frozen Beef Juice.—One cup of beef juice prepared by cold process; the white of one egg beaten to a stiff froth, and well stirred in. Season with salt and pepper and, if desired, a dash of celery salt. Turn into a jar and freeze to the consistency of thick mush.

Beef Tea.

Bottled.—Select and prepare the meat in the same manner as for bottled beef juice, except for every pound add half pint of cold water. Place in a covered jar and proceed as per bottled beef juice.

The liquid thus obtained will resemble beef juice in every respect except in strength. Better served in a red wine-glass or china cup.

With Hydrochloric Acid.—This is the most easily absorbed form of beef drink, but there is frequent objection to the taste and color. The tea may be heated until it steams and changes to a brownish hue; do not strain out the flakes of coagulated albumin and fibrin which will appear, as they are the most nutritious portion of the tea.

To Prepare.—Select one-half pound of good beef; remove everything from it that is not clean meat; chop it fine and run it twice through a meat grinder. Put into a bowl one cup of water and five drops of dilute hydrochloric acid. Stir into this the chopped meat and set it in a refrigerator or any cool place for two hours to digest. Then strain, flavor with salt and pepper, and serve in a red wine-glass, preferably.

Beef Tea.

1 pound of lean fresh meat.
1 quart of cold water.

Cut the meat in small pieces, place in double boiler, and cover with cold water. Fill the lower half of boiler with cold water. Place all over a slow fire and cook for two hours or more. Stir frequently. Strain, season with salt; skim off any globules of fat—if broth is hot remove by touching the globules with tissue or plain paper. If allowed to cool it is easily taken off.

Beef Broth.

1 pound of lean beef (cut in small pieces).
1 piece of bone from the shin of beef.

1 quart of cold water.

Put all in a kettle and bring slowly to a boil; then simmer two hours or more until reduced to one pint of liquid. Strain, season with salt, and cool quickly. Remove all fats.

The seasoning may be varied by addition of a spray of parsley, a few drops of celery seeds, or a little onion.

Pounded rice, barley, wheat, tapioca, or slice of bread (toasted or stale) may be added if more nutriment is desired.

Beef Broth.

To one pint of chopped lean beef add one pint of cold water, let it stand in a covered glass fruit jar for four to six hours. Cook for three hours in a closed jar over a slow fire, strain and skim off the fat—clear with egg, season, and serve warm or cold.

Beef Broth (Memorial Hospital, Richmond, Va.).

1 pound of beef.

1 pint of water.

Put in a saucepan over slow fire and raise to boiling point. Press juice out of meat with potato masher continually while cooking. Season with salt and pepper, and, if desired, celery salt.

Mutton Broth.

1 pound of mutton from neck or loin.

1 quart of cold water.

1 teaspoon of chopped onion.

Remove from mutton the tough skin, fat and membranes, and cut meat in small pieces. Break the bone in several places.

Put all together in a saucepan and simmer for three hours. Then strain out the meat, season, and remove all fat.

To vary the taste of broth, a little mint, parsley, bay leaves, or celery seed may be added one-half hour before removing from fire.

Barley, sago, or rice may also be added.

Beef Jelly.

¾ cup of good beef broth, well seasoned.

1 teaspoonful of gelatin.

Cover gelatin with tablespoonful of broth. Heat the rest of broth and add to gelatin. Stir until dissolved. Strain through gauze or fine strainer. Put on ice or in cool place until it becomes a jelly. This will require about an hour. Serve plain or on lettuce leaf.

For soft diets this makes a savory dish. A small piece of sweetbread or shreds of chicken can be put in before congealed.

Bouillon.

Follow recipe for beef broth. To one quart of this add a pinch of thyme, sage, and mint, and one teaspoonful each of chopped onion and carrot. Boil all together until one-fourth boiled down. Clarify with white of one egg (see directions for clarifying chicken jelly) and serve.

Consommé.

½ shin of beef.

½ shin of veal.

Brown sugar, one tablespoonful.

½ onion sliced. Water, two quarts.

Wipe dry the shins, have them well cracked; remove the

meat from the bones and cut into small pieces. Put the tablespoonful of sugar and onion into the soup kettle to brown and burn. Put in the meat, shake, and stir until the meat seems slightly scorched. Then add the bones and the water (cold). Cover the kettle and bring slowly to boiling point and then allow it to simmer for three hours. Strain and stand aside to cool. When cold remove every particle of fat. Season to taste.

In addition to onion, celery tops, bay leaves, cloves, or grated carrot may be added about one hour before removing from the fire.

Chicken Broth.

Select a full-grown chicken, singe, wash, and draw it. Remove the breast and put it aside for other purposes. Disjoint the chicken and crack the bones. Place in kettle with three quarts of cold water. Simmer gently for three hours or until the liquid is reduced to one and a half quarts. Add salt, and if desired onion, parsley, celery tops or seeds, half an hour before removing from fire. Strain and cool quickly.

When cool, remove fat from top and sediment from bottom. It may be further improved by reheating and adding the white of one egg slightly beaten. Bring to boil and continue boiling for a few moments; then strain through several thicknesses of gauze or cheese cloth.

By placing in mould and putting in cool place it can be served as chicken jelly.

Chicken Jelly with Gelatin.

$\frac{3}{4}$ cup of chicken broth (well seasoned).
1 teaspoonful of gelatin.

Cover gelatin with a tablespoonful of water. Heat the broth and add to gelatin. Stir until thoroughly dissolved. Strain through gauze or fine strainer. Pour into moulds and stand in cool place until it becomes a jelly. Serve plain or on lettuce leaf.

Chicken Jelly with Irish Moss.

$\frac{1}{8}$ cup of Irish moss.
1 cup of chicken broth.
Follow directions as above.

Oyster Broth.

8 medium-size fresh oysters.
1 cup cold water, or
$\frac{1}{2}$ cup cold water and $\frac{1}{2}$ cup milk.
Salt and pepper to taste.

Chop oysters fine in a chopping tray and turn into saucepan with the fluids; set saucepan on the fire and let it come slowly to boiling point; then simmer for five minutes and serve. Better to make as needed, as flavor is impaired by keeping. Can be made in twelve minutes.

Oyster Tea.

Put eight large oysters and one dozen medium with their liquid in a stewpan; simmer for five minutes. Then strain the liquor, leaving out the oysters and add to it one-half cup of milk; set it back on the stove and heat it just to the boiling point. Season with salt and pepper and serve.

Clam Broth and Bouillon.

6 clams in their shells.
1 cup cold water.

Thoroughly scrub the shells with small brush, place them in small saucepan and pour over them the cup of water. Bring slowly to the boiling point, or until the shells open.

Strain immediately through two thicknesses of gauze. Dilute to taste with warm water. Serve hot or cold. It does not require any salt, as clam juice is usually salt enough.

Clam Broth or Bouillon.

6 clams and 1 cup of cold water.

Drain the clams, saving the juice, and chop clams very fine. Place them in small saucepan, with their own juice and the cold water. Bring slowly to a boil, stirring frequently, then simmer about five minutes. Skim carefully. Strain through two thicknesses of cheese cloth. Dilute to taste with warm water. Serve hot or cold.

Clam Broth, Frozen or Clam Frappe.

Follow directions as for frozen beef juice, substituting clam broth for beef tea.

Milk Preparations.

Milk Peptonized and Pancreatinized.—One tube of Fairchild's peptonizing powder (which contains 5 grains of pancreatic extract and 15 grains of bicarbonate of soda) and empty its contents into a quart bottle. To this add one gill of cold water and shake until the powder is fully dissolved, then add one pint of cold milk and shake again. The bottle is then set into a bowl of warm water, which should be of such a heat that you can hold your hand in it for a minute; the temperature is thus raised to about 100° F. The milk is kept in the water for half an hour;

it is then put upon ice and the digestion will continue until the milk is thoroughly chilled.

Milk Sterilized for Infants.—Put the milk into flasks or bottles, which have either been boiled in soda-water or well washed with soda and scalded. Plug them with stoppers of clean cotton-wool, place the flasks in a wire frame to support them in a kettle of cold water, heat gradually to 190° F., and keep in that temperature for one hour. Cool quickly and keep on ice. When it is to be used, it should be heated by placing a bottle in warm water for a few moments.

Sterilized Milk (Invalids).—Pour milk into a granite saucepan or a double boiler; raise the temperature to 190° F. and keep it at that point for one hour. As soon as done, place in pitcher or jar (with covered lid) that has been boiled or scalded and cool quickly. Place in ice-box.

Pasteurized Milk.—Fill bottles, which have been sterilized, with fresh milk and plug with cotton-wool (not absorbent cotton). Place on bottle rack or on wooden rest in a boiler partly filled with cold water. Raise the temperature (using a thermometer) to a temperature of 165° F. and let it stand for thirty minutes. Cool quickly and place on ice.

To Alter the Taste of Milk.—A grating of nutmeg, a blade of mace, a dash of extract of vanilla or lemon, a little ginger or caramel may be added. If alcohol is not contraindicated, many patients find milk in the form of weak punches or as an eggnog, very agreeable.

Milk and Lime-water.—Lime-water may be purchased at drug stores or prepared at home. If the milk is desired hot, add the lime-water after it has been heated.

To Prepare the Lime-water.—Take a piece of unslaked lime about the size of a walnut and place in an agate or earthen vessel. Cover with two quarts of filtered water and stir thoroughly, then set aside to settle until clear. Use only the clear solution from the top. Keep tightly covered, as constituents of the air precipitate the lime.

Koumiss—1 quart of fresh milk.

$\frac{1}{5}$ of a cake of Fleischman's yeast.

1 tablespoonful of sugar.

Dissolve the yeast in a little water and mix it with the sugar and milk. Put mixture in beer-bottles and cork tightly. Shake the bottle for a minute and place in ice-box. Not good under six days, but will keep indefinitely.

Milk and Cinnamon.—Boil in one pint of fresh milk, sufficient sticks of cinnamon to flavor it pleasantly and sweeten to taste. If allowed, brandy, whiskey, or sherry wine may be added.

Milk with Coffee, or Nutritious Coffee.—Put 1 tablespoonful of ground coffee into saucepan containing 8 oz. of milk and 4 oz. of water, which should be nearly boiling before coffee is added; boil together for three minutes. Beat up an egg and pour coffee upon it and return to fire for a few minutes; if preferred drink without the egg.

Milk Punch.—1 cup of milk.

2 tablespoonfuls of whiskey or brandy.

1 teaspoonful of sugar.

A little grated nutmeg.

Sweeten milk with the sugar, stir it into the brandy and mix thoroughly by pouring from one glass to another. Grate nutmeg on top.

Improved by using a milk shaker, or a Mason jar answers every purpose.

Whey with Pepsin.—½ pint milk.

1 teaspoonful of essence of pepsin.

Heat the milk to a temperature of about 100° F. Gently stir in the pepsin. Let it stand in a warm place until it has formed a firm jelly (about one-half hour). Beat with a fork until the curd is finely divided, then strain slowly. Throw away the curd or cheesy portion; it is no good whatsoever.

For flavoring purposes add lemon juice, sherry, cocoanut, or vanilla.

Wine Whey.—Cook one cupful of milk, and when it begins to steam add one-half cup of sherry wine. Bring to a boil. Strain carefully and slowly. Add one teaspoonful of sugar and serve.

One stick of cinnamon added while boiling improves the flavor.

Lemon Whey.—This is made in the same way as the foregoing recipe, using one ounce of fresh lemon juice instead of the wine.

Milk Lemonade.—1 cup of milk.

¼ cup of wine (sherry).

¾ cup of boiling water.

½ lemon. Sugar to taste.

Pour boiling water over the sugar, add the lemon juice and sherry. Stir until the sugar is dissolved; add the cold milk and stir again until the milk curdles, then strain through a jelly bag or piece of linen.

Milk and Cereal Water.—Equal parts of milk and thoroughly cooked barley, rice, oatmeal, or arrowroot-water. Salt to taste.

Albuminized Milk.—1 cup of milk.

1 tablespoonful of lime-water.

Beaten white of one egg.

Shake in Mason jar or milk shaker.

Milk with Other Diluents.—Milk may be diluted with great advantage by adding Vichy, Apollinaris, Seltzer, or some other sparkling table-water.

Junket, Slip or Curds and Whey.—½ pint of fresh milk. Heat to 100° F. (sweeten to taste if desired). Add 1 teaspoonful of Fairchild's pepsin or rennet, pour into a shallow dish or custard cups and let it stand until firmly curdled. It may be flavored with wine, which must be added before curdling takes place. Nutmeg may be grated on top.

Egg Preparations.

Sherry and Egg.—Break an egg into a bowl and beat with it 1 teaspoonful of sugar. After the sugar is thoroughly mixed with the egg add 2 tablespoonfuls of sherry wine and pour the mixture over a glass of shaved or finely cracked ice.

Instead of the ice 1 cup of hot water may be added and the whole placed over a gentle fire and stirred in one way until it thickens; do not let it boil.

Eggnog.—1 egg, 2 teaspoonfuls of sugar.

Grating of nutmeg.

1 cup of cold milk.

2 teaspoonfuls of brandy, whiskey or wine 1 tablespoonful.

Separate the egg; beat yolk up well with sugar; add the white beaten to stiff froth; stir in the milk and pour from one glass to another several times; then add the brandy. Grate nutmeg on top.

Cocoa with Wine.—1 teaspoonful of cocoa.

4 oz. of boiling water.

1 oz. of port wine. Sugar to taste.

Mix cocoa and water together and sweeten as desired; then add the wine. Serve at once.

Cocoa.—Cocoa, 1 teaspoonful.

1 cup of milk. Sugar to taste.

Extract of vanilla, ½ dram.

Philips' digestible cocoa best for invalids, as fat has been removed. Mix the cocoa with hot water into a paste and stir into the milk which has just reached the boiling point. Stir for a few moments, but do not allow it to boil. Add the vanilla just before pouring into cup.

Cocoa Shells.—Put 2 teaspoonfuls of cocoa shells into 8 oz. of cold water and simmer for two hours; add ½ cup of milk and bring to boiling point. Sweeten to taste.

Hot-water Tea.—Mix in equal proportions boiling water with milk which has just reached boiling point.

Racahout.—1 tablespoonful of racahout.

½ cup of boiling water.

½ cup of milk.

Dissolve racahout in the water; add the heated milk. This is used in varying strengths. Frequently racahout is ordered without milk, especially for infants and children.

Mulled Wine.—½ pint of water.

1 egg.

½ cup of wine.

1 teaspoonful of fully broken stick cinnamon.

1 tablespoonful of sugar.

1 whole clove.

Add the clove and cinnamon to the water, bring slowly to a boil, and steep ten minutes. Beat the egg until light and add sugar. Add the wine to the water and, when hot, strain and pour slowly over the egg and sugar, beating all

the while. Set it on the fire until consistency of cream Beer, ale, and porter may be mulled in the same way.

Mulled beer is called beer soup by the Germans.

Albuminized Water, or Egg Water.—Dissolve the white of an egg slightly beaten (a very fresh one) in a cup of cold water; shake gently or stir well until thoroughly blended. Strain only if necessary. If not used immediately, keep near the ice, closely covered, and shake or stir again before using.

Grape juice, pineapple juice, orange, lemon, or prune juice may be added to conceal the white of the egg, and it makes a most pleasant drink. Sweeten to taste and serve with cracked ice.

Lemon or Orange Albumin.—Make a cup of lemon or orangeade; beat the white of an egg to a froth and add sugar as desired and beat to a stiff froth. Pour into the fluid and whip lightly, allowing part of egg to come on top. Serve with cracked ice. Pineapple juice or grape juice makes a delightful substitute for the lemon or orange.

Egg Flip.—Beat 1 fresh egg with 2 teaspoonfuls of sugar; add 1 teaspoonful of vanilla and beat again until sugar is dissolved; add 5 oz. of cold milk, stirring all the while. Serve with cracked ice.

Soft Custard.—½ pint of milk.

Yolk of 1 egg.

1 tablespoonful of sugar.

Pinch of salt.

Put the milk in saucepan and set it on the stove to boil; beat together the yolk of egg, the salt and the sugar in a bowl, and when the milk just reaches the boiling point pour it in slowly until all is mixed. Return it to another saucepan (or the one that the milk was cooked in, if it

has been washed and dried) without delay for three minutes, stirring very slowly. Care should be taken not to undercook the custard or have it cooked too much, as it will have a curdled look. After removing from the fire flavor it with vanilla and pour into glass from which it will be served.

It may be also flavored with cinnamon (pieces of broken cinnamon stick cooked with milk before adding to egg), sherry, or nutmeg.

Baked Custard.—½ pint of milk.

1 egg.

1 tablespoonful of sugar.

Pinch of salt.

Piece of cinnamon bark.

Put the cinnamon and milk together in saucepan and set on stove to heat. Break the egg into a bowl, add salt and sugar, and beat them until well mixed, but not light. When milk boils remove the cinnamon and pour it on the beaten egg; stir it slowly for a moment and pour into custard cup. Place the cup in a deep round pan and pour boiling water around, almost to the top.

Bake in a moderately hot oven for twenty-five minutes.

If a very small amount of butter has been rubbed on cup, the custard can be served out of cup in which it has been baked, as it will slide out in a round shape and will look more tempting.

Soft-cooked Eggs.

Place one or two eggs in a vessel, pour over them one pint of boiling water and let them stand in a warm place (not on the fire) for from eight to ten minutes, according to the size of the eggs. The vessel should remain un-

covered. If the egg remains in water longer than the required time, it will not become hard unless the temperature of the water is raised.

Poached Eggs.

Select a very fresh egg. Toast a slice of bread and butter it. Have some water boiling in a shallow pan. Break the egg in a saucer, take the pan off the stove, and slide in the egg. Finish cooking below the boiling point, basting the yolk continually, until the white is tender and jelly-like. Lift out the egg by means of a skimmer and place it on toast.

Season with salt and pepper and a bit of butter, if desired.

Scrambled Eggs.

Beat one or more eggs very light and add one ounce of milk for each egg; put eggs in a buttered pan and stir constantly until of a jelly-like consistency.

The fire should not be very hot.

Demulcent Drinks.

Barley-water, No. 1.—Take 2 tablespoonfuls of pearl barley, and wash well with cold water, rejecting the washings. (If possible, soak the barley for a few hours.) Add 1 quart of cold water. Put in a covered vessel and bring gently to a boil and simmer for two hours, which will reduce it to about 1 pint. Strain through a sieve and add salt. Serve hot or cold as directed. When not desired plain or with milk, lemon juice and sugar may be added, or sherry, whiskey, or wine.

Barley-water, No. 2, *Infants.*—Moisten 1 tablespoonful of barley flour (Robinson's Barley Flour being

good) with a little cold water. Add 1 quart of water and boil gently for twenty minutes with stirring or cook in a double boiler, having the water in under part boiling all the time.

Rice-water, No. 1.—Wash carefully 2 tablespoonfuls of rice with cold water, rejecting the washings. Cover with 1 quart of cold water and bring slowly to boiling point and simmer gently for two hours, which will reduce it to about 1 pint. Strain through sieve and add salt to taste. Serve hot or cold as directed.

Rice-water, No. 2.—Same as Barley-water, No. 2, using rice flour instead of barley flour.

Oatmeal-water.—Add 1½ tablespoonfuls of rolled oats or oatmeal to 1 quart of cold water. Bring gently to a boil and simmer for about two hours, which will reduce it to about 1 pint. Strain.

Arrowroot-water.—Mix 1 teaspoonful of arrowroot with a little cold water and stir into 1 pint of boiling water; boil for five to eight minutes.

Gum Arabic Water.—½ pint of boiling water.

1 teaspoonful of gum arabic.

Dissolve the gum arabic in boiling water. Serve plain, with lemonade, or wine may be added.

Flaxseed Tea.—½ cupful flaxseed to 1 quart of boiling water; boil for half-hour and remove to cooler portion of stove to further thicken. Strain and add the sugar and lemon juice.

Toast-water.—Toast three slices of bread very brown, cutting bread about half an inch thick; break into small pieces, put into a pitcher with one pint of cold water; set aside to soak for one hour. At end of that time turn into a strainer and squeeze out the liquid with the back

of the spoon. Then strain through a piece of linen. This is either served hot or cold. A little cream and sugar may be added, or a pinch of salt.

Gruels.

Gruels are cooked mixtures of grain or flour, with water, or milk and water. A thorough cooking is necessary for digestion, as the largest ingredient of grain is starch.

Gruels may be flavored with cinnamon, nutmeg, or almond. A small dash of sugar improves the taste.

Drink slowly, that the starch may be thoroughly mixed with saliva to ensure good digestion.

Arrowroot Gruel.—1 tablespoonful of arrowroot.

1 saltspoonful of salt.

1 scant teaspoonful of sugar.

1 cup of hot water.

1 cup of milk.

Mix the arrowroot with the cold water (first mixing as a paste, then adding all the water) and cook until perfectly clear. Add the milk cold and stir until it reaches the scalding point. Serve hot, adding the salt and sugar.

Without Milk.—If desired, the milk can be left out, using more water.

With Cream or Wine.—Pure cream can be added, or wine, if ordered.

With Egg.—Just before removing it from the fire add the beaten yolk of an egg and stir in the well-beaten white. Cook a moment, stirring all the while and serve as above.

Cornmeal Gruel.—1 tablespoonful of meal (country ground preferred).

1 ounce of pure cream (if desired).

Sugar (if desired).

$1\frac{1}{2}$ cups of boiling water.

1 cup of milk.

Sift the meal and scald with the boiling water. Simmer for an hour or more; then add milk which has just reached scalding point. Add sugar and cream and serve. If desired, before removing from fire the well-beaten yolk of an egg and the white beaten to a stiff froth may be stirred in. Cook for a moment, stirring all the while. Omit cream if egg is used.

Oatmeal Gruel.—Prepare as for cornmeal gruel, only using 2 tablespoonfuls of the oatmeal.

Strain before adding the milk to remove the hulls.

Cream, sugar, or egg may be added as above described.

Barley Gruel.—4 tablespoonfuls of barley flour.

1 pint boiling water.

Pinch of salt.

Moisten barley with a little cold water. Pour on the boiling water, stir and boil for twenty minutes. Strain after adding one cup of milk if desired. Season to taste.

Mush and Porridge.

Mush is meal or grain cooked in water to consistency of rather thin pudding.

Porridge is like mush, only thinner.

These being generally made of coarsely ground or rolled grains, a long boiling is necessary to ensure good digestion.

All mixtures should be sufficiently cooked to acquire the consistence which just enables it to be poured. Oatmeal and Indian meal require four to five hours boiling.

Wheat Gems, Granula, Pettijohn's Breakfast Food,

Avena Oats, etc., having been partially prepared by dry heat, require only about one-half hour's boiling. Farina requires one hour's boiling. Cook all mushes in a double boiler.

Oatmeal Mush.—½ cup of rolled oats.

½ teaspoonful of salt.

1 pint of boiling water.

Pick over the oatmeal and put into a double boiler with salt. Pour on the boiling water and cook for four or eight hours. The water in the under boiler should boil during this time and will occasionally need replenishing. Serve the mush steaming hot with butter or sugar and cream. Oatmeal is best cooked the day before needed, as long cooking improves rather than injures the grain.

Indian-meal Mush.—1 cup of cornmeal.

1 teaspoonful of salt.

1 quart of boiling water.

Wash the cornmeal, removing all black specks. Make into a paste with a little cold water; then pour in the boiling water and add the salt. Cook in a double boiler for four or five hours.

Hominy Mush.—1 cup of hominy.

1 teaspoonful of salt.

1¼ quarts of water.

Pick over the hominy carefully and wash. Put all together in a double boiler and cook for three hours. Add more water if mush is too thick. Serve steaming hot with butter.

Solid Meat Preparations.

Raw Beef.—Scrape with a sharp knife a thick piece of steak (preferably from top of the round), and after

removing all fats and tendons, if not already in a complete pulp, run through a mincer or pound in a mortar. Flavor with salt and pepper.

This may be eaten in the form of a sandwich between thin buttered bread; or,

Beef Balls.—Rolled into balls with a little white of egg and broiled in pan for a couple of minutes, or until the outside turns gray. Use only a speck of butter to keep from sticking. Serve on lettuce leaf or on round crackers, which have been heated.

Beef Pulp.—Procure slice of steak, free from all fat; cut meat into strips and run through mincer three times. The pulp must then be well beaten up in roomy saucer with cold water or skimmed beef tea to consistency of cream. The right proportion is three teaspoonfuls of liquid to one ounce of pulp; stir mince briskly with wooden spoon the whole time it is cooking, over slow fire or on cool part of range until hot through and the red color disappears. When done it should be a soft, smooth, stiff paste of the consistency of a thick cream. Season with salt and pepper. To be eaten hot. It should be served in a bouillon cup which has been heated.

Meat Jelly.—This is made by cooking good, boneless, lean beef with water (proceeding as for making broth) until it becomes gelatinized.

Chicken Jelly.—Clean a fowl that is about a year old, remove skin and fat; break the bones and place all together in a pan containing two quarts of water. Let it come gently to a boil and simmer five or six hours; add salt, white pepper, or parsley to taste, strain and remove all fat. Pout into moulds and put in cold place.

Soups.

Chicken Soup.—Thoroughly clean a fowl. Separate it at the joints and break the bones. Put all together in a saucepan with about three pints of water and stew it until it becomes very tender and the stock is nutritious.

Season with onion, parsley, celery, or curry powder. Cut the nicer portions of meat into small pieces and serve with soup. Thicken with white sauce made of flour and butter.

Two hours before removing from fire, barley, rice, celery (cut into strips) may be added. One-half hour before removing from fire noodles (alphabet or string) may be added.

One hour before removing from fire, spaghetti or white potatoes cut in blocks may be added.

Mock Bisque, or Cream of Tomato Soup.—½ pint of tomatoes, measured after they have been stewed and strained.

½ pint of white sauce.

½ saltspoonful of soda.

Salt and pepper to taste.

Strain the tomatoes, after cooking, through a coarse wire strainer until there is nothing left but seeds. To this add soda, salt, and pepper. Make a white sauce with one tablespoonful of butter, one of flour, and one-half pint of milk. Add this to tomatoes, strain all into a double boiler, return to the fire, and serve as soon as it becomes hot.

Cream of Celery.—½ head of celery.

½ pint of water.

½ pint of white sauce.

1 tablespoonful of butter.

½ cup of milk.

1 tablespoonful of flour.

Salt and pepper to taste.

Wash and scrape celery, cut it into strips, put it into one-half pint of water, and cook until very soft. When done, mash it in the water in which it was boiled and add salt and pepper and strain through soup strainer. Make a white sauce and add to the fluid. Return the soup in a double boiler to fire and heat until steaming, and serve immediately.

Spinach Soup.—1 pint of spinach.

½ cup of white sauce.

½ cup of milk.

1 tablespoonful of flour.

1 tablespoonful of butter.

½ cup of cold water or stock.

Salt and pepper to taste.

Pick the leaves from the pint of spinach. Wash through several waters, be careful to free it from any sand. Put it into a saucepan with cold water or stock, bring to boiling, then simmer until tender (about ten minutes). Press all through a fine sieve. If it does not measure half a cup, add more water or stock.

Return to fire and add the white sauce, stirring constantly in all directions until it boils. The yolk of an egg may be lightly beaten and added a few moments before removing from fire.

Water-cress Soup.—Substitute water-cress for the spinach and proceed as for cream-of-spinach soup.

Cream-of-rice Soup.—1 tablespoonful of rice.

¾ cup of chicken stock or water.

½ cup of milk.

1 piece of celery.

1 tablespoonful of butter.

Yolk of 1 egg. Season to taste.

Put the rice, celery, and water into a double boiler and cook until very tender and soft. Press all through a sieve, return to the double boiler, and add the milk and butter; cook ten minutes longer, stirring frequently. Add salt and pour the mixture slowly over the well-beaten yolk. Return to fire to reheat, but do not let it boil.

Miscellaneous Recipes.

Baked Potatoes.—Select medium-size potatoes. Scrub thoroughly in cold water. Bake in a hot oven until soft (about forty-five minutes). Remove from the oven and gently roll in a cloth between the hands to make them mealy. Crack the skin to allow the steam to escape. Serve immediately with butter, pepper, and salt.

Boiled Rice.—1 tablespoonful of rice; $\frac{1}{4}$ teaspoonful of salt.

1 pint of boiling water.

Wash rice in cold water. Have the water boiling in saucepan, add the salt and sprinkle in the rice slowly. After all the rice is in the water stir once, then do not stir again. Boil rapidly until soft. Pour into a collander to drain. Each grain should be whole.

Milk may be substituted for the water. It should be cooked in double boiler when milk is used.

Stewed Celery.—Scrape and wash the stalks in cold water. Cut into pieces about one inch long. Drop into boiling salted water and let the water come to a boil and cook until tender.

Serve in cream sauce.

How Corn Should be Eaten by Invalids.—Cut through centre every row of grains with sharp knife, spread lightly with butter and with the teeth press out the centre of the grain, leaving the hull on the cob, this being the only part indigestible.

Gluten Bread.—½ cup of milk.

½ cup of boiling water.

2 eggs, ¼ oz. compressed yeast cake.

Gluten flour; a little salt.

Pour the boiling water into the milk, and when lukewarm add the yeast cake, which has been dissolved in a little water, then add enough gluten flour to make a thin batter and beat well. Add the two eggs well beaten; then enough flour to make dough. Do not knead, but turn into a greased pan. Cover and stand in a warm place, until it doubles its bulk. Bake in moderate oven for one hour.

Gluten Pan Cakes.—Add gluten flour to one or two eggs and beat into a batter. Cook on soapstone griddle. They may be sweetened with a little saccharin.

Spoon Bread.—1 cup of milk or water.

⅓ cup of white cornmeal.

2 eggs. A pinch of salt.

Beat the eggs well, add the milk, and stir the mixture well into the meal. Add the salt and turn into the greased baking dish.

First scalding the meal with boiling water improves the bread.

Creams, Ices, etc.

Invalid's Cream.—½ pint pure cream.

White of 1 egg.

Sugar to taste.

Vanilla extract, 1 dram.

Mix cream, sugar, and vanilla together and freeze to the consistency of mush; then add the beaten white of the egg and freeze. This is an excellent quickly made cream. Freeze in a pint freezer or with an impromptu freezer, which answers every purpose. Any small tin bucket will do—a long, narrow one being preferable. Place it in the middle of a deep dish or bucket (one with hole in it answers best) and proceed as for a regular freezer. Turn bucket around by means of the handle—it is well to cut around the sides two or three times while freezing.

If not desired for immediate use, allow the melted ice to run out of hole in bucket and repack.

Sherry Cream.—Proceed as for above, adding one ounce of sherry for the vanilla. Lemon extract, grated chocolate, cocoa, chocolate syrup, peach extract, or caramel may be substituted.

Frozen Custard.—Make a soft custard (according to rule on page 364). When done, strain into a granite pan and set aside to cool. Then add 6 ounces of pure cream or the white of 1 egg beaten to a stiff froth. Freeze.

Lemon Sherbet.—1 pint of water.

½ cup of lemon juice.

Sugar to taste.

White of 1 egg.

Make the lemonade; strain and freeze to the consistency of mush; then add the beaten white of 1 egg and freeze.

Lemon sherbet may be made without the egg, substituting instead gelatin, to the proportion of 1 tablespoonful to 1 pint of water.

Orange Sherbet.—½ pint of water.

½ cup of orange juice.

1 tablespoonful of lemon juice.

Sugar to taste.

White of 1 egg.

Make the orangeade, adding the lemon juice and the sugar; strain all through a strainer and freeze to consistency of mush; add the beaten white of 1 egg and freeze.

Gelatin may be substituted for the egg if desired.

If an orange color is desired, add a couple of drops of orange coloring.

Peach Sherbet.—Three ripe peaches.

Sugar to taste.

White of 1 egg.

Select solid but ripe peaches. Pare and remove the stones. Place in a bowl and mash fine; add the sugar and white of egg, which has been whipped to stiff froth. Mix well and beat again. Freeze.

Blanc Mange.—1 cup of milk.

1 egg.

1 tablespoonful of cornstarch.

Sugar to taste.

2 tablespoonfuls of pounded almonds.

2 teaspoonfuls of sherry, or

1 teaspoonful of vanilla extract.

Bring milk to boiling point and add cornstarch (which has been moistened with a little cold water). Stir until it thickens. Add the yolk, lightly beaten; cook just a moment, remove from fire, and add sugar. Pour this into the well-beaten white of egg, beating all the while and adding gradually the pounded almonds. Serve in moulds.

White Blanc Mange.—Make as the preceding recipe, omitting the yolks of eggs. It may be colored a delicate pink by adding three or four drops of carmine.

Irish Moss Blanc Mange.—$\frac{1}{3}$ cup of dry moss.

1 quart of milk.

Sugar to taste.

Soak the moss for three-quarters of an hour in warm water. Wash each piece separately under a stream of cold water, removing all sand. Put moss in a bag (tied) and cook in double boiler in the milk for one hour. At end of that time remove from fire, add the sugar, strain it into moulds, and set in cool place to harden. Serve with whipped cream or soft custard.

Wine Jelly.—$\frac{1}{2}$ cup of sherry.

$\frac{1}{4}$ box of gelatin.

$\frac{1}{4}$ cup of cold water.

$1\frac{1}{2}$ cups of boiling water.

Cinnamon and clove, 1.

Sugar to taste.

$\frac{1}{2}$ cup of lemon juice.

Put gelatin and cold water in soak for one-half hour; then pour the boiling water, in which a clove and a stick of cinnamon have been simmering, over the softened gelatin. Add the sugar, lemon juice, and wine and stir until the gelatin and sugar are perfectly dissolved; then strain through flannel bag and cool in a frigerator, or if desired immediately place in impromptu freezer, but do not freeze —simply subject it to intense cold.

Cinnamon and clove may be omitted, as well as the lemon juice.

Lemon Jelly.—Proceed as for the above, substituting 1 cup of lemon juice for the wine. A dash of brandy improves the flavor.

Orange Jelly.—Proceed as for wine jelly, substituting 1 cup of orange juice for the wine and using $\frac{1}{4}$ cup of lemon juice.

Fruit Jelly.—Proceed as for wine jelly, using $\frac{1}{2}$ box of gelatin. After straining add sliced orange, Malaga grapes (split and with seeds removed), and sliced bananas. Serve with whipped cream.

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